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Chapters of the Association have been organized in important cities in the United States. Information concerning the meetings of these chapters may be secured from the District Representatives listed on another page.

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THE COUNTING OF FARMS IN THE UNITED STATES

By John D. Black and R. H. Allen
Harvard University

A census undertaking as simple as counting the farms in a country serves to illustrate several important aspects of the assembling and use of statistics in their relation to public administration. First as to the significance of such a count: the simple numbers of farms, taken at their face value, as given in the first column of the table following, indicate that the agriculture of the United States expanded until 1920, although slowly toward the end, then contracted to 1930, and has since started on a new period of expansion. The second column shows that the average size of these farms, measured in acreage, declined in 1920–25, increased strikingly in 1925–30, and decreased again in 1930–35. But the average size of farms, we shall shortly discover, is affected by the completeness of the enumeration. Counting the number of rented farms involves classifying all farms as they are counted. The numbers of these appear to have increased slowly and evenly from 1910 to 1925 and then more rapidly. The percentages of number of farms rented, on the other hand, increased rapidly from 1925 to 1930, but not at all afterward.

TABLE I

CENSUS DATA OF FARMS IN THE UNITED STATES, 1880 TO 1935

	Number of farms	Acres of land per farm	Number of rented farms	Percentage of farms rented
1880	4,009,000	134	1,025,000	25.6
1890	4,565,000	136	1,295,000	28.4
1900	5,737,000	146	2,025,000	35.3
1910	6,362,000	138	2,355,000	37.0
1920	6,448,000	148	2,455,000	38.1
1925	6,372,000	145	2,463,000	38.6
1930	6,289,000	157	2,664,000	42.4
1935	6,812,000	155	2,865,000	42.1

If we were to examine these same data by states, we would find significant departures from these averages. Thus in the New England states the numbers of farms began to decline before 1900; but in the Mountain states they reached a new high point in 1935. In the Great

Plains states the size of farms apparently kept increasing until 1920, and in some of these states even until 1930 or 1935. The tenancy ratio remained stable from 1930 to 1935 because of a decline in the South that offset a larger increase in the North and West.

These are all significant measures of social change. They produce the sorts of data upon which agricultural programs and agricultural legislation are based. All of them are in fact used in the recent report to the President recommending farm tenancy legislation. Still more important, once such legislation is enacted, the administrators of it rely upon these data for numerous details of organization plans, prorations by areas, and the like. The trend of public policy surely points strongly toward more rather than fewer of such uses.

Now as to the statistical problem involved in counting farms: Surely it is harmless enough in appearance. But it has been solved satisfactorily by few if any census organizations. Fifteen years ago the senior writer gave up trying to make some valuable international comparisons of agriculture because the counting of farms followed so varied a procedure in different countries. Later study revealed that some countries make little attempt to distinguish farms as such. In Switzerland, the unit of enumeration is the "enterprise," and an effort is made to classify all enterprises according to whether agricultural, industrial, or the like. Agricultural holdings of less than 25 acres are classified as agricultural if crops are grown or livestock kept "for business purposes." Those above 25 acres are agricultural even if the products from them are all used by the family.[1] Forestry and agriculture are not separated. In the 1930 Rumanian census, the unit is the holding of land under one operation, irrespective of acreage, type of land-use, or location.[2] Greece made its first attempt to count farms in 1925, the term not hitherto having been used. No area limit was imposed.[3]

The reasons for the difficulties are apparent from conditions in these three countries. In Switzerland, a considerable proportion of the families combine farming with other activities. This same condition largely prevails in parts of Rumania and Greece. In Rumania, especially, a sizable fraction of the rural families have obtained a large part of their livelihood by working on large landed estates; but most of these families have patches of land ranging from a few square rods to a few acres upon which they produce part of their sustenance.

[1] Switzerland: *Guide to Official Statistics of Agriculture, Food Supply and Population.* Part II. J. D. Black and Frits Bachman. Published in Bibliography 35 of the Bureau of Agricultural Economics, United States Department of Agriculture.

[2] Similar publication for Rumania. Bibliography 49. Part II. J. D. Black and Constantin Ladas.

[3] Bibliography 39 in the same series. Part II. J. D. Black and Constantin Ladas.

That the conditions complicating the counting of farms in the United States differ from those described only in kind and degree is illustrated by Dr. David Rozman's study of part-time farming in a township in Massachusetts located in the outskirts of Worcester, in the course of which he obtained a report of garden, crop and livestock production for each family. He concluded that if the United States Census definition of a farm had been rigorously applied, twice as many "farms" would have been counted as the enumerator of the township finally reported in the preceding census (1925).[4] Inquiry revealed, moreover, that the enumerator had been sent back twice before he obtained as full a count as he reported. Apparently on his first trip around he had reported as farms only those commonly so recognized in the community. Evidence presented following suggests that the situation discovered by Dr. Rozman repeats itself in greater or less degree in most of the industrial Northeast and around urban centers elsewhere.

In the Southern states, the enumeration is further complicated by the counting as separate farms of small tracts of land cultivated for a share of the harvest by croppers, who are technically farmers for census purposes, but still laborers in the community mind. The part-time farming group in the South includes many who work as laborers on larger farms while operating a little land by themselves, in some cases only as croppers.

The United States Bureau of the Census has made a vigorous effort to deal with this problem. Before taking the 1930 census, it discussed the subject freely with federal officials using agricultural census data, and held conferences in which state workers and others participated. Two somewhat divergent opinions developed, one to the effect that the definition of a farm should be restricted to include only establishments commonly recognized as farms in the communities, and the other that the same definition be continued but more rigorously applied. Those interested in counting the farm population, begun in 1925, held the first opinion. Otherwise they would be confronted by the dilemma of having many heads of rural households reported as having outside occupations—perhaps factory work, carpentering, mail carrying—while also technically the operators of "part-time" farms. Another group wanted rural households with outside occupational sources of income removed from the farm totals because including them reduced average farm incomes unless outside income could also be enumerated. The procedure adopted was the compromise of keeping

[4] Unpublished information obtained in connection with his study *Part-time Farming in Massachusetts*, Massachusetts State Experiment Station Bulletin 266.

the same definition for the count of farms, but defining a farm for population purposes to include the clause, in italics, "and which is also locally regarded as a farm."[5] Inasmuch as the same enumerators filled in both farm and population schedules, the result was disastrous. As we shall see later, some enumerators followed one definition, some the other, and apparently many of them some uncertain combination of the two.

It is best to describe this episode as another mishap resulting from the attempt to introduce a count of *farm* population into the census system. Almost any important innovation of this kind is likely to produce similar disruptions. There had been a mishap when the first attempt was made in 1925, but it had mainly affected the population enumeration.[6]

The real origin of the difficulty lies in the taking of the first quinquennial census of agriculture in 1925 with no general occupational census to go with it. This, we shall see later, had introduced some important abnormalities into the count of farms in that year, and also had produced a peculiar reporting of farm population which the census officials were trying to correct in 1930.

As a guide to later enumerations, the census officials also agreed to the further compromise of using in 1930 two supplementary schedules covering agricultural production less than that normally required as minimum for a farm. One supplementary schedule, which placed the lower limit at two or more cattle or three or more hogs or the equivalent of these, was used in nearly all counties; and the other, with one or more cattle or hogs or the equivalent as the lower limit, was used in 324 sample counties. The data obtained were too incomplete and erratic to be published. Moreover, the adding of these schedules confused the enumerators and considerably affected the regular count of farms.

After much discussion and prompting from government and other users of agricultural census data, the Bureau of the Census in taking the 1935 census tried out the plan of asking the enumerators to report a farm schedule for every establishment having any appreciable agricultural output, leaving to the central staff the job of classifying these as farm or non-farm. Partly as a result of this change in census procedure, but also in part because of actual changes in agriculture, the 1935 census reported a half million more farms than that of 1930; and

[5] *Instructions to Enumerators—Population and Agriculture*, Fifteenth Census of the United States, p. 25.

[6] The undercounting of farm population in 1925 had caused the Department of Agriculture to overestimate the migration from farms to cities in the decade of the '20's.

the increases mostly appeared in the areas where part-time farming is prevalent. The 1935 farm population count was in general increased by the inclusion of the families on the farms brought in for the first time by the new procedures; and also affected in other ways not so clearly apparent. The writers have not dealt with this phase of the subject in the pages following. They are expecting it to be treated in a forthcoming report of the National Resources Committee. The principal objective of this article is to review the efforts of the Federal Census to obtain a better count of farms, especially in recent decades, and to analyze the effects of changes introduced, as a basis for planning the 1940 census.

DEFINITION OF "FARM"

In terms of area, 3 acres or more of land under one management upon which agricultural operations are conducted has been the accepted census minimum for a farm in the United States since 1870, except in the count of 1900 when no lower limit of any kind was specified except that market gardens and the like must employ the time of at least one man. The censuses before 1900 also accepted places of less than 3 acres as farms if they had $500 worth of products. Since 1910, this figure has been $250.

Dropping the minimum specifications in 1900 increased the count somewhat. Thus 41,000 farms under 3 acres were reported in 1900, of which 29,000 had less than $250 worth of production; and imposing the $250 limit in 1910 caused only 18,000 farms under 3 acres to be reported.

The deficiencies in this definition that have become apparent are as follows:

(a) It does not agree with local ideas of a farm in that it includes not only smaller establishments, but also many which are largely dependent upon other sources of income. The related difficulty with croppers and laborers in the South has already been stated. Under these circumstances, local enumerators cannot generally be expected to report according to instructions.

(b) The definition itself imposes no real production requirement upon a farm of 3 acres or over. Large numbers of these have very little agriculture upon them, consisting mostly of uncultivated land. This of course confuses the enumerators. The census officials probably eliminate some of these in the editing process but have never published a statement on this point that might serve as a guide to users of the census data.

(c) Stating the minimum in dollars does not allow for changing

values of farm products, such as occurred from 1919 to 1924, and from 1929 to 1934. The evidence clearly suggests that the number of small farms reported has been affected by this.

The proposal to meet these difficulties by asking enumerators to report only what are locally regarded as farms has not been acceptable to users of census data. They fear that the count thus obtained will vary with local ideas as to what constitutes a farm, and from one census to another with changing enumerators, so that they will never know what really is counted as a farm. Those who have followed the subject closely are generally of the opinion that the enumerators should be instructed to report all agricultural production on any place, letting the central staff do the classifying in the office. They hope that other types of classification besides mere size in acres can be developed, the "part-time" grouping made in 1935 furnishing an example of such a classification. They would like the census reports to indicate clearly the limits of the classes, as did the type-of-farming reports of the 1930 census. What they want, therefore, is continuation along lines developed in the 1930 and especially the 1935 census. They particularly want no abandonment of the procedure started in 1935 of having the enumerators report all possible farms, even though, as will appear later, it did not achieve its full intent at the first attempt.

COUNTING OF FARMERS

Any counting of farms is also likely to be confused by an attempt to count the number of "farmers" at the same time, as in all the regular decennial censuses. To be counted as a farmer in the occupation part of the census, a man needs to have farming as his principal source of income; but many heads of households living on farms earn more as factory workers, miners, roadworkers, carpenters, mail carriers, and the like, than from their farming activities. Table II shows that in the earlier censuses, more farmers were reported than farms, due mainly to certain difficulties over farms operated by tenants and croppers in the South, and over ranches upon the public domain in the West. An attempt was made in 1900 to identify farm and occupation returns, thus to have a farm for each farmer; and this practice has been continued since. But this does not entirely solve the problem for the enumerators. They tend to report farming as the occupation of the head of the household on every place for which they take a farm schedule; or conversely, take a farm schedule only for those households which report farming as the principal source of income. This cannot fail to distort the count for both. Apparently in 1930, the

enumerators more commonly chose the second of these alternatives. The 1935 procedure went a good way toward meeting this difficulty; but not far enough, it will presently appear. There should be a greater excess of farms over farmers than has appeared in any census to date.

TABLE II

CENSUS COUNT OF FARMS AND FARMERS,* UNITED STATES, 1880 TO 1930

	Farms	Farmers
1880	4,009,000	4,327,000
1890	4,565,000	5,427,000
1900	5,737,000	5,637,000
1910	6,362,000	6,199,000
1920	6,448,000	6,387,000
1930	6,289,000	6,012,000

* Includes in 1920: Farmers, general farms, dairy farmers, stock raisers, florists, fruit growers, gardeners, landscape gardeners, nurserymen, apiarists, and poultry raisers; and the nearest equivalent of these classes in other census years. In 1910 and 1920, turpentine farmers could not be separated from "farmers," and in 1910 "poultry yard laborers" from "poultry raisers." Similar minor difficulties were encountered in other years.

PECULIARITIES OF THE QUINQUENNIAL CENSUS

Although the complications of simultaneous counting of farms and farmers do not arise when an independent farm census is taken, as was the case in 1925 and 1935, certain advantages of such counting are also lost. Thus, not having at such times to locate farms under 3 acres to obtain population data for them, the enumerators fail to find large numbers of them. The census of 1930 reported 38,263 such farms compared with 15,151 in 1925 and 35,558 in 1935. The instruction to enumerators in 1935 to bring in all farms apparently was partly effective with this group of farms. It brought in nearly as many as the 1930 census; but the 1930 census was very incomplete for all small size groups.

The next two size groups, 3 to 9 acres and 10 to 19 acres, were no doubt also affected in 1925 by this same tendency toward being overlooked, but in less degree. Actually more farms were reported in these groups in 1925 than in 1930 in a majority of the geographic divisions, including all the divisions with a significant amount of part-time farming in them, and scattering states or groups of counties of the same description elsewhere. The reason for this is that in the regular decennial censuses, large numbers of these are omitted from the farm count as soon as the enumerators discover that the head of the household has a regular job or occupation off the farm.[7] This tendency apparently more than offsets the tendency in quinquennial censuses not to locate small farms in all size groups except that of under three acres.

[7] The 1920 count was lower than the 1925 for the 3- to 19-acre groups in all geographic divisions.

Hence neither type of census represents a complete enumeration. The count of farms in the 20- to 49-acre size groups in 1930 indicates the same type of omissions, though in lesser degree in six of the nine geographic divisions. Careful comparisons of 1925, 1930 and 1935 totals by size groups and by geographic divisions indicate that as many as 300,000 farms may have been omitted in 1930 which were included in one of the other two years.

Such an estimate, however, can have no secure basis as long as derived from the census data themselves because of the changes in census procedure.[8] Part of the increase in numbers reported by the census in 1930–35 no doubt reflects an actual increase in part-time farming and resumption of subsistence farming in this period. Probably there was a fairly steady increase of part-time farming during most of the period from 1925 to 1935, a continuation of a movement well started before 1925. Such evidence as we have indicates no acceleration of the movement in the depression of the '30's.[9] The 1930 census reported too little of the movement; and the 1935 census, while reporting more of a change since 1930 than occurred, nevertheless failed to inventory the full absolute amount of part-time farming, not only because of the omission of farms under 3 acres already noted, but also because of remaining incompleteness of count even in 1935, to be discussed presently.

The 1925 census was peculiar in omitting many of the larger farms. In Table III, it will be noted that six of the geographic divisions reported increases in 1930 in farms of 175 acres or more as compared with decreases in 1925. The remaining three divisions reported much smaller decreases than during the preceding period. State censuses taken in 1925, especially the excellent state census of Iowa agriculture, indicate that these sizable decreases in numbers of large farms did not generally occur. The table only roughly reveals this census phenomenon. The size groups most clearly affected by it vary by divisions.

[8] The extreme range of possible estimates is from 180,000 to 480,000.

[9] Significant evidence that no acceleration occurred lies in the fact that the 1935 census reported only 572,000 farm operators as engaged in non-agricultural work off the farm for 150 days or more, as compared with 540,000 in 1930. The 1935 figure is only 8.3 per cent of the number of farms in that year, as compared with a corresponding 8.5 per cent in 1930. No significant differences in changes by geographic divisions appear: the New England states were highest in both years, 20.7 and 19.0 per cent respectively; the West North Central states lowest, 5.1 and 5.0 per cent respectively. These data are subject to the limitations imposed by the omissions already discussed, but since these omissions were most serious in 1930 the effect is to overstate the increase in outside employment. Professor I. G. Davis has even concluded that the movement was retarded in 1930–33 because of a shortage of resources of would-be part-time farmers—" . . . this increase in part-time farming occurred more rapidly between 1920 and 1930 than it did after 1930. After 1930, the movement toward part-time farming was retarded by the economic depression." (*Types of Farming and Type-of-farming Areas in Connecticut;* Storrs Agricultural Experiment Station Bulletin 213, p. 29.) Recent studies in Southern territory have revealed a strong movement toward part-time farming, particularly since 1930.

In Iowa and Kansas, for example, the groups above 260 acres show it most strikingly.[10] Omission of these larger farms in 1925 so seriously disturbed the totals for acreage and output of many farm products that the Division of Crop and Livestock Estimates had difficulty in using them as bases from which to compute year-to-year estimates of change. The table suggests that this difficulty was overcome in the 1935 census.

TABLE III

PERCENTAGE CHANGE IN NUMBER OF FARMS, 175 ACRES AND OVER, REPORTED BY THE LAST FOUR CENSUSES, BY GEOGRAPHIC DIVISIONS

	1920 to 1925	1925 to 1930	1930 to 1935
New England	−10.4	−1.6	3.0
Middle Atlantic	−10.8	2.2	2.6
E. N. Central	−3.4	7.2	2.8
W. N. Central	−1.7	6.4	4.2
South Atlantic	−9.8	−3.3	15.7
E. S. Central	−14.1	−1.3	11.0
W. S. Central	−7.2	16.2	9.8
Mountain	−9.6	1.6	4.6
Pacific	−11.0	0.6	1.4

METHODS OF ANALYSIS

Exactly how incomplete the 1930 enumeration of farms was, and how much of the increase of a half million farms reported in 1935 was due to correcting for this, how much to the use of new methods that counted more places as farms than ever before, and how much to an actual increase in part-time or subsistence farms, or resumption of activities upon essentially subsistence farms, cannot be determined with a finality that will confound all those who may have reason to disbelieve. Nothing short of carefully controlled surveys made soon after the census enumerations would suffice for such a purpose. Several types of analyses can be made, however, which will convince almost anyone doing the actual job of analysis that somewhat the larger portion of the increase was due to the first two influences.

One of these types of analysis is a comparison of changes between census periods by size groups for separate states. The consistency of these reported changes with the circumstances and explanations stated above leaves little room for reasonable doubt. The writers respectfully ask any doubting person to turn to the size group data for his state

[10] The most plausible explanation thus far suggested for the relatively full counting of small farms in 1925, and relatively incomplete counting of larger farms, is as follows: The enumerators in 1925 were paid on a per-farm basis. They could make the best money where farms were small and close together; but were inclined to omit doubtful places for which pay might be refused. They could not make wages trying to canvass large farms or thinly settled areas. By contrast, the 1930 enumerators secured their best pay from listing people for the population count. The agricultural schedule was long and the pay low in proportion to time involved. Hence, it was easy to list population and let the agricultural schedule go in all anywise doubtful cases.

for 1920, 1925, 1930 and 1935 and relate the changes he observes to the circumstances here related connected with the taking of these censuses; and then do the same for several states in other parts of the country. Another method of analysis is to compare by counties the changes in number of farms between censuses, and then relate these to changes in numbers by size groups. Most convincing of all, is to record on a map by townships the number of farms reported in each of the censuses since 1925, if the data have been obtained that far back. Those since 1930 will be highly informative.

The writers have not been able to perform these analyses for the whole United States. The first type of analysis was used for a majority of the states; the second for ten selected states; and the last for selected towns in New England. Space does not permit including the detailed results of these analyses. Only a few samples and summaries can be presented. In choosing New England for the more detailed analysis, the writers were aware that they would find there in pronounced form the manifestations to be observed. They expected to learn from New England not the extent of the under- and over-enumeration, but the nature of it and the reasons for it. They were seeking here for a qualitative explanation, not a quantitative measurement to be extended to the rest of the country.

THE ENUMERATION IN NEW ENGLAND

Table IV presents a comparison of census counts by states of New England from 1910 to 1935. Conceivably the apparent definite reversal of trend in 1920–25, the very sharp decline to 1930, followed by expansion to 1935, could really have happened. But other available evidence indicates instead a steady downward trend, slackening at the end in southern New England, and probably turning upward somewhat here in 1930–35. The comparison in terms of size group changes strongly supports this description. The direction and percentage amplitude of change are approximately the same for Massachusetts and Connecticut—up slightly in 1925, down sharply in 1930, and up very sharply

TABLE IV

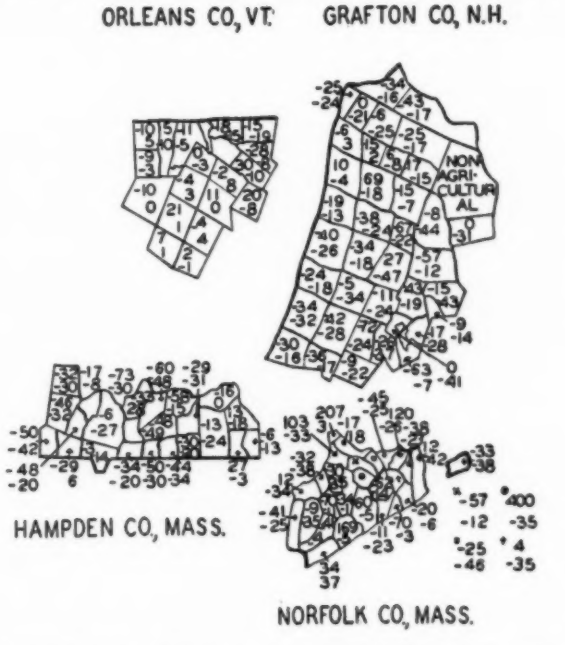
CENSUS COUNTS OF NUMBER OF FARMS IN NEW ENGLAND, 1910 TO 1935

	1910	1920	1925	1930	1935
Maine	60,016	48,227	50,033	39,006	41,907
New Hampshire	27,053	20,523	21,065	14,906	17,695
Vermont	32,709	29,075	27,786	24,898	27,061
Massachusetts	36,917	32,001	33,454	25,598	35,094
Rhode Island	5,292	4,083	3,911	3,322	4,327
Connecticut	26,815	22,655	23,240	17,195	32,157
Total for New England	188,802	156,564	159,489	124,925	158,241

in 1935—for all size groups under 49 acres. This statement roughly fits Vermont, New Hampshire, and Maine for the size groups under 19 acres. In northern New England, the size groups from 20 acres upward turned sharply downward in 1930 and recovered only part way in 1935. In southern New England, the size groups above 50 acres showed only a slight downward tendency in 1930, which was roughly

CHART 1

PERCENTAGE CHANGES BY TOWNS IN NUMBER OF FARMS REPORTED, CENSUSES OF 1925 AND 1930, FOUR COUNTIES OF NEW ENGLAND



UPPER FIGURE - PERCENTAGE CHANGE IN PARTICULAR TOWN
LOWER FIGURE - AVERAGE OF PERCENTAGE CHANGE IN ADJOINING TOWNS

offset in 1935. These trends are entirely consistent with a more complete enumeration of small farms (except those under 3 acres) in 1925 than in 1920, a less complete enumeration in 1930 and an enumeration in 1935 even more complete than that of 1925. These tendencies characterized all of New England, but were more pronounced in the more industrialized areas.

The extreme variations between towns in the same county, which certainly must be due in large measure to variations in the enumera-

tion, are indicated by Chart 1, which compares the changes for the towns in four counties with the average changes of the immediately adjoining towns, to obtain a rough measure of the extent of erraticness in the 1925–30 changes. Orleans is one of the most agricultural counties of New England, and Grafton a rough county abutting upon the White Mountains. Hampden gives us a cross-section of the Connecticut River Valley, and Norfolk an area near a large city. That these differences appear in adjoining towns generally throughout New England is evident in Chart 2, in which increases and decreases are shown on the same map according to their magnitudes for the following five-year period, 1930–35. In general, the increases are large near the cities, but without much regularity, and some surprising increases appear elsewhere. The decreases have this much system that for the most part they are localized in certain counties, especially in Maine and northern Vermont. This map and a size-group analysis, which space does not permit including, strongly suggest a relative under-enumeration in Maine in 1930 of farms under 20 acres especially, and the same in lesser measure for Vermont.

The exceptional enumeration given Connecticut in 1935 requires special consideration. In this JOURNAL in September, 1933,[11] Professor I. G. Davis of Connecticut State College compared the results of a survey of 12 Connecticut towns conducted under his direction in 1931 with those of the 1930 census. In 1934 he re-surveyed the same 12 towns and added 39 new towns to his sample.[12] The same definition of a farm was used as in the census except that no establishments with less than 3 acres of land were included. The results were fairly consistent with the 1925 census count, the differences with a few exceptions being only such as might have occurred in the intervening periods. The 1925 census, as explained above, probably omitted very many of the farms of under 3 acres. The survey omitted all of them by definition. The 1930 census count probably should have been larger than the 1931 survey count because of including more farms of less than 3 acres. In all but two towns the reverse was true. A size-group comparison for Connecticut indicates that the omissions occurred most strikingly in the groups under 49 acres.

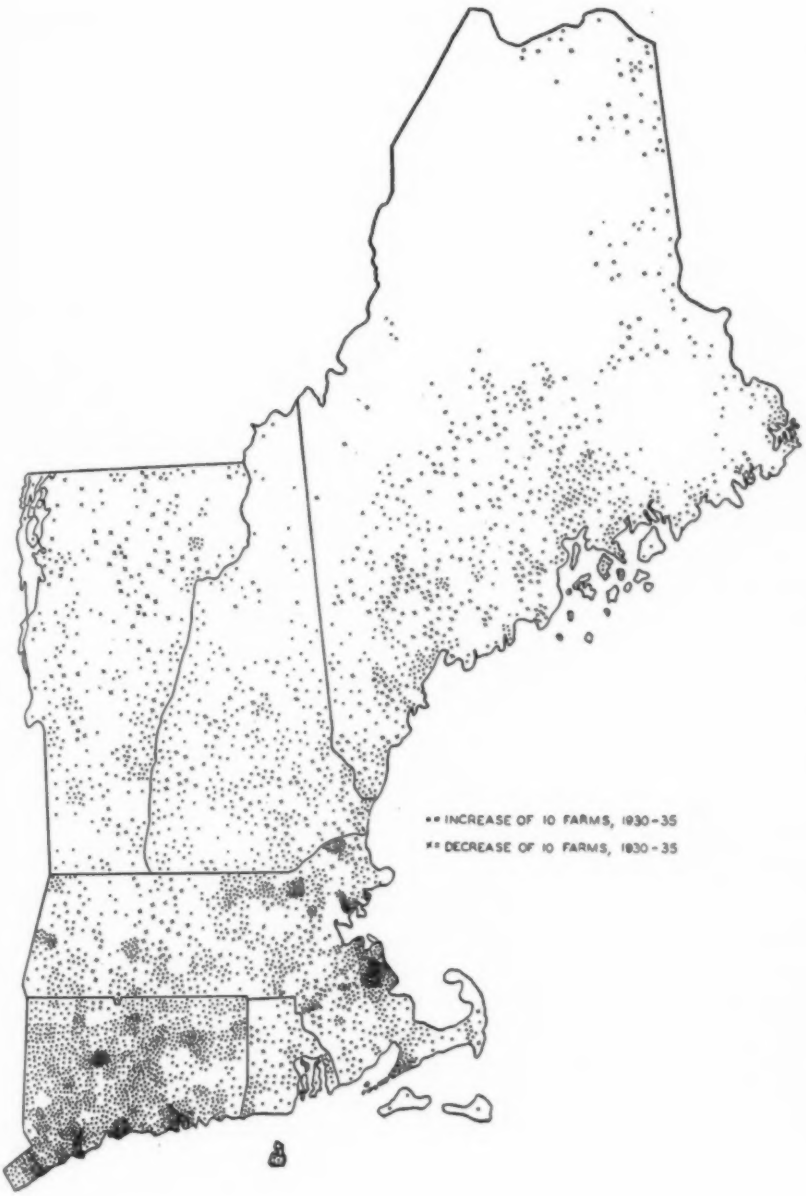
Now as to the 1935 census count: in 15 towns it does not vary more than 10 per cent from the 1934 survey; in 31 it is more than 10 per cent larger; and in the remaining 5 it is more than 10 per cent smaller. It would therefore appear that in a majority of towns, the enumerators followed their 1935 instructions with a fair degree of consistency. The

[11] Pp. 272–85.

[12] Data from this survey were kindly supplied by Professor Davis.

CHART 2

CHANGES BY TOWNS IN NUMBER OF FARMS REPORTED, CENSUSES OF 1930 AND 1935, NEW ENGLAND



census administrators had become acutely aware of the difficulty of counting farms in southern New England, and in Connecticut in particular, and made a determined effort to obtain a reporting of all places with any agriculture at all. Of the schedules returned, several thousand, principally in the smaller size groups, were sorted out in the editing process because of having too little agriculture upon them. Some small farms may still have been omitted by the enumerator in the towns showing small excesses of census over survey counts. The excess of the census over the survey in a majority of the towns probably consisted partly of farms under 3 acres not included in the survey and partly of farms of over 3 acres having relatively little agricultural production which were omitted in the survey. A few may have been part-time farms developed after the survey was made, and a few others may represent omissions in the survey.

The farms of under 3 acres included in the census but not in the survey were no doubt mostly farms properly included under the census definition; and no doubt many of those of over 3 acres omitted in the survey. When the census count exceeds the survey count, it probably represents more nearly a true count in terms of the census definition as it is written (but not commonly applied).

Among the 51 towns, however, were 9 in which the survey count exceeded the census count, in one case by 80 per cent. Comparison of the two sets of data indicates that the enumerators in these towns failed to follow the revised census instructions consistently. Some did not follow them at all. We may therefore conclude that because not all the enumerators followed the revised census instructions of 1935, and others probably followed them with less than full consistency, there was still some undercounting of farms in Connecticut in 1935, as compared with a counting under a strict application of the census definition. The undercount could easily have been as much as two thousand farms.[13]

It therefore appears that even the 1935 counting of farms in New England was far from complete and seriously erratic. The enumeration in Connecticut approached a full count, but was probably still incomplete in many towns. The evidence points to much more undercounting in the rest of New England, especially in Maine and northern Vermont. This undercounting, it should be borne in mind, is relative to the actual number of establishments meeting the census definition, not relative to earlier censuses, which were still more incomplete.

[13] Uncertainty as to what the census practice really is for farms of over 3 acres having small output makes such estimates as this very hazardous.

THE ENUMERATION ELSEWHERE

How much like the New England enumeration was that of the rest of the country? The states included in Table V represent most of the important sets of conditions found in the United States. The Pennsylvania data show a sequence of changes much like that for New England as a whole. The Iowa and Kansas data differ in showing no decrease in 1930; there are relatively few part-time farms in these states to disturb the enumeration. Indiana and Wisconsin are intermediate between Pennsylvania and Iowa. Virginia data show some southern influence, but much resemble those for Pennsylvania. They also roughly describe the changes in Maryland, Delaware, West Virginia, and even fit Kentucky and Tennessee fairly well. In California the pattern of change is roughly that of New England imposed upon an upward trend line. This same description fits Wisconsin and Minnesota in some measure. The Alabama data roughly fit the cotton states except that Georgia and Mississippi had fewer farms in 1935 than in 1930.

TABLE V

CENSUS COUNT OF NUMBER OF FARMS FOR SELECTED STATES, 1920 TO 1935

	1920	1925	1930	1935
Pennsylvania	202,250	200,443	172,419	191,284
Virginia	186,242	193,723	170,610	197,632
Alabama	256,099	237,631	257,395	273,455
Wisconsin	189,295	193,155	181,767	199,877
Indiana	205,126	195,786	181,570	200,835
Iowa	213,439	213,490	214,928	221,986
Kansas	165,286	165,879	166,042	174,589
Wyoming	15,748	15,512	16,011	17,487
California	117,670	136,409	135,676	150,360

We may therefore conclude that the data resemble those for the New England states in showing a decline in 1930, or at least a much smaller rate of increase, except in the South and the Western Corn Belt, and a pronounced upturn to 1935 in nearly all sections. However, this upturn is not as pronounced as in New England, and is least in the Western Corn Belt and some parts of the South.

The explanation of many of these changes may be discovered from a study of Table VI, which presents significant size-group data for these same states. The undercounting of farms of less than 3 acres in 1925 is apparent in every state. This undercounting was much less in 1935. All the states with the possible exception of Wyoming show evidence of underenumeration of farms in the 3- to 19-acre groups in 1930, if we may judge by the relatively large increases evident in 1935. These increases appear to be much larger than could be explained by the development of part-time and small-scale farming. The under-

counting was largest in the eastern states and the Great Lakes states like Wisconsin. The considerable increases of farms of 175 acres and over in 1930 reflect in part the undercounting of large farms in 1925. The increases of these large farms in the 9 states in 1930–35 probably represent actual trends. A detailed analysis of size-group changes by individual states, which could not reasonably be presented here, supports the generalizations derived from these two tables.

TABLE VI

PERCENTAGE CHANGES IN COUNTS OF FARMS FOR CERTAIN SIZE GROUPS, FOR 9 SELECTED STATES

States	Under 3 acres		3 to 19 acres		175 acres and over	
	1925–30	1930–35	1925–30	1930–35	1925–30	1930–35
Pennsylvania	+ 103	−48	−31	+45	+5	0
Virginia	+ 325	+ 3	−31	+57	−1	+ 5
Alabama	+ 296	−24	+ 6	+42	0	+22
Wisconsin	+ 236	−36	−30	+59	+7	+ 9
Indiana	+ 293	0	− 9	+47	+9	+ 2
Iowa	+ 960	−58	+10	+28	+5	+ 1
Kansas	+1201	−69	+ 7	+49	+6	− 1
Wyoming	+ 22	−23	+90	+77	+1	+ 4
California	+ 113	−21	− 4	+27	+2	+ 3

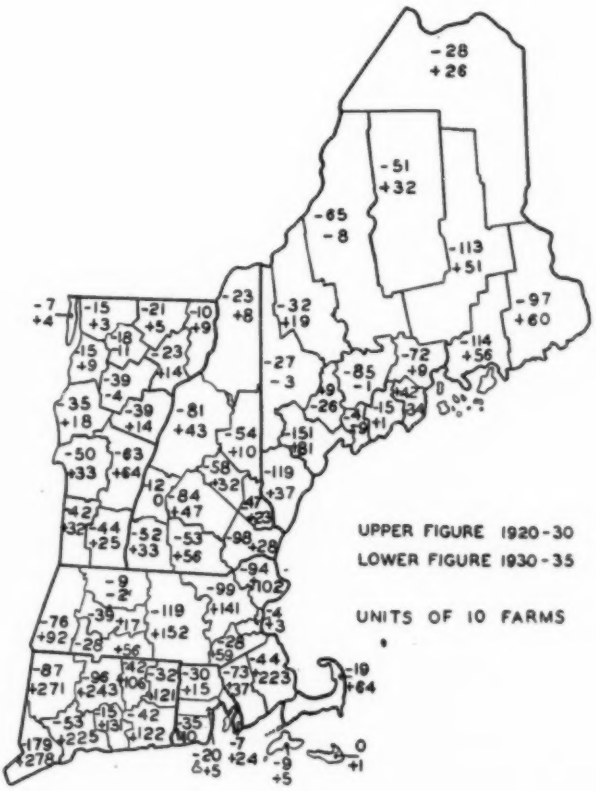
Another approach is to compare the changes between censuses county by county, placing the results upon outline maps as in Chart 3 for the six New England states. Such maps were prepared for seven other states. In general the changes in the East are in opposite direction, first minus and then plus, for 1920–30 and 1930–35 as in most of New England. Pennsylvania furnishes only six examples to the contrary. In the South, however, there are many counties, sometimes grouped and sometimes scattering, where continuous increases or decreases appear. Many California counties show continuous increases. The same is true of Iowa and Kansas, but the increases are small. In the newer states with few part-time farms, the general upward trend is ordinarily enough to offset the relative undercounting in 1930. One would really need measures of departure from trend to detect effects of enumeration practice in much of this territory. The principal evidence of erratic counting of farms in these maps takes the form of occasional difference in direction and amount of change in adjoining counties for which no adequate other explanation is available. Thus the data for Jefferson County, Wisconsin, indicate a decrease throughout the period, whereas all the surrounding counties show first a decrease and then an offsetting increase. Obviously this approach to the problem gives no conclusive answer. It merely makes one wish for data that do report the actual changes that occurred.

More needs to be said about the enumeration in the South. Appar-

ently there was an actual decline in numbers of farms in 1930–35 in many of the strictly cotton counties of the South. An analysis of the data for 170 such counties, selected so as to exclude those in 1930 with cities of 10,000 or over in them, with less than 40 per cent of their land

CHART 3

CHANGES BY COUNTIES IN NUMBER OF FARMS REPORTED, CENSUSES OF 1920, 1930, AND 1935, NEW ENGLAND



in cotton and less than 1000 croppers, made by Frey and Smith of Louisiana State University[14] indicates that the number of croppers in these counties decreased 11 per cent and the number of other tenants one per cent. Table VII shows fairly conclusively that this came about through the combination into larger farms, at least in the enumeration, of farms chiefly in the size group from 20 to 49 acres. In terms of numbers, the decrease for this size group more than offset the increase of

[14] *Rural Sociology*, Vol. 1, December, 1936, pp. 483–505.

larger farms for six of these nine states; but the acreage involved in the increases was greater than that in the decreases, and hence total land in farms increased for all of these states. There are at least two possible explanations of this reported combination of the medium-sized farms into larger farms. One is that an increase in the use of machine cultivation in cotton growing has made possible an increase in size of farms with consequent substitution of hired laborers for croppers. This factor is applicable chiefly in the western portion of the Cotton Belt. The A.A.A. program together with widely fluctuating cotton prices was probably responsible for some part of this development, although the evidence on this point is not clear.[15] Public work relief no doubt contributed to the same effect by providing employment between the peak

TABLE VII

CHANGES IN NUMBER OF FARMS BY SIZE GROUPS BETWEEN 1930 AND 1935 FOR SELECTED COTTON-GROWING STATES

	Under 20 acres	20–49 acres	50 acres and over
North Carolina	+14,637	− 3,064	+ 9,686
South Carolina	+ 5,631	−10,052	+11,994
Georgia	− 60	−21,809	+16,815
Tennessee	+23,222	− 39	+ 3,943
Alabama	+16,136	− 8,485	+ 8,409
Mississippi	+15,053	−22,797	+ 6,764
Arkansas	+13,087	−11,357	+ 8,949
Louisiana	+ 9,458	− 4,364	+ 3,677
Texas	+15,977	−16,625	+ 6,176

periods of employment on the plantations. Mapping of the changes by counties also shows sufficient grouping of the decreases, such as in the Yazoo Delta counties, and the Black Waxy Prairie of Texas, to support a theory of actual decrease in numbers in these and other sections. There is even more grouping of increases in the mountain counties of the South, and around a few urban centers like Birmingham where subsistence and part-time farming are prevalent.

Outside of these particular sections, which include most of the counties studied by Frey and Smith, the pattern of change, although generally upward in 1935, as in the New England states, is sufficiently irregular as between counties in the same section to suggest that differences in enumeration in many cases may have more than offset the actual changes. This points to the conclusion that differences in enumeration procedure also affected the count elsewhere, but not enough to obscure the large actual changes occurring.

Georgia and South Carolina present a particular problem. Table VII shows an actual decrease in numbers of small farms in Georgia, and only a small increase in South Carolina. There is a fully compensating

[15] Nourse, Davis and Black, *Three Years of the Agricultural Adjustment Administration*, pp. 340–53.

increase in numbers of larger farms. But these changes nevertheless set these states out in sharp contrast with the rest of the South. Special conditions probably are responsible for these differences; but the manner in which they coincide with state boundaries is somewhat disconcerting, at least faintly suggesting that the count for whole states may have been affected by enumeration procedure, as already pointed out for New England.

The census count of Southern farms in 1925 and 1930 was more irregular than that of 1935, if we may judge by the size-group analysis. Thus, relative to other southern states, North Carolina was high in 1925, and then low in 1930, in the size groups under 20 acres. Mississippi and Texas had large increases in these groups both in 1925 and in 1930. In the next larger size group, 20–49 acres, North Carolina and Texas showed large increases in 1925; but in 1935 North Carolina continued upward and Texas turned downward. These are merely instances of the varied pattern of change reported for the smaller size groups. These differences may be wholly explained by special circumstances such as the passage of the crest of the boll-weevil wave across the South from west to east; but they may also reflect in part a variation from state to state in census practice with respect to the counting of cropper units.

The geographical distribution of the 1930–35 changes in numbers of small farms, on the other hand, suggests that the enumeration of small owner farms affected the results fully as much as the enumeration of croppers. It is true that while the owner farms in 10 southern states, North Carolina to Texas and Oklahoma, increased 13 per cent in 1930–35, the cropper farms decreased 12 per cent. But there are many more owner than cropper farms. The number of other rented farms remained the same. These statements are consistent with the 7 per cent increase in total population in these same Southern states between 1930 and 1935, compared with less than one per cent in eleven North Central states exclusive of the border states.

The extent to which part-time farming entered into the farm counts of 1930 and 1935 is suggested by the fact that for the 200 counties of the United States, North, South and West, selected by the 1930 Census of Manufactures as having industrial importance, the 1935 census reported an average increase of slightly over 500 farms. These counties contained one-fifth of all the increase in farms reported in this period. How much of this was actual increase in part-time farming and how much was due to census counting, we shall probably never know.

Reference has been made in several places to resumption of farming as a factor, along with increase in part-time farms, in the increased

count of farms in 1935. The two can scarcely be separated. In many cases, no changes of situs of the family was involved. Having less employment in industry in 1933 than in 1930, they depended more upon their land and were more likely to call themselves farmers. But in some sections there was actual resumption in the sense that families moved upon farms that had been temporarily vacated. But scattering evidence from many sources indicates that these two forms of resumption did not account for any large part of the increase in the count.

The foregoing is by no means a full coverage of all the factors affecting the completeness of the enumeration of farms at the different census periods. No doubt the changes in date of taking the census affected the number of cropper and tenant tracts counted as farms. The spring date of taking the 1930 census apparently contributed to the peculiarities of that enumeration. As already suggested, the change in the price level caused fewer establishments of less than 3 acres to be counted as farms in 1935. But all of these appear to have been minor factors when measured against those here analyzed. Their influence on other items in the census, such as number of livestock or farm laborers, has been of much more importance than upon number of farms.

SUMMARY STATEMENT

At this point we may bring our analysis to certain conclusions. The methods used, while offering no incontrovertible evidence as to the 1935 count of farms outside of New England, furnish strong presumption to the effect that as large a percentage of the farms in the smaller size groups were omitted in most of the northern and western states as in New England. Because of the lesser proportion of small farms, however, the effect of this undercounting on the total number of farms was relatively not so important elsewhere, especially in the Corn Belt and the West. As for the South, the question is so involved with the counting of cropper farms that we must speak more qualifiedly; but no doubt there was appreciable undercounting of small farms here also.

But as compared with the 1930 census count, that of 1935 was unusually complete. It was the most complete count ever made with the possible exception of that of 1900. The 1930 count was the least thorough of any since 1890. The omissions in 1930 were mostly part-time farms in the size groups under 50 acres. The 1910 and 1920 censuses had omitted very many of these. The 1925 brought some of these into the enumeration. The 1930 census dropped these and some that had been counted in 1920. The 1935 census brought all of these back and more besides. But even it failed to get large numbers of them in most

towns outside of Connecticut and in many towns even in Connecticut. The number of farms involved in the changes in enumeration behavior for 1920 to 1935 was a considerable percentage of the total number only in the Northeastern states, in industrial counties scattered over the country, and in a few scattered areas such as the southern Appalachians, the cut-over regions of the Great Lake states, and some sections of the Pacific states. But it affected the count of farms by at least several thousand in most of the states. If all the farms conforming to the census definition had been counted in 1935, the total might well have shown a further increase of a few hundred thousand in addition to the half million increase reported.

RELATED EFFECTS

Obviously the proportion of farms counted cannot be changed as extensively as since 1890 without its affecting the enumeration of land in farms, livestock and many other items. But the effect on these items will not be as great as upon numbers in any case where the smaller farms are mainly involved. Thus apparently the omission of relatively few of the larger farms in the 1925 enumeration made the farm production data less usable than did the omission of several times as many small farms in 1930. That the effects in 1930 were still important, however, is demonstrated by the data in Table VIII. The

TABLE VIII

PERCENTAGE CHANGES IN LAND IN FARMS IN NEW ENGLAND REPORTED BY CENSUSES SINCE 1920

State	1920–25	1925–30	1930–35
Maine	− 5	−10	+ 2
New Hampshire	−13	−13	+ 8
Vermont	− 7	− 2	+ 4
Massachusetts	− 5	−15	+ 9
Rhode Island	− 7	−10	+10
Connecticut	− 4	−18	+38
New England	− 7	−10	+ 8

1930 census reported 10 per cent less land in farms in New England than the low 1925 enumeration, the percentages ranging from −2 in Vermont to −18 in Connecticut, whereas the 1935 census showed an average increase of 8 per cent, the percentages ranging from +2 in Maine to +38 in Connecticut.

The effects of the relative underenumeration of land in farms in 1925 and 1930 are apparent for the United States as a whole in Table IX. A comparison of the 1935 data by size groups with those for 1920, the last "normal" census, suggests that as many as 2,000,000 acres above the last "normal" enumeration, that of 1920, may have been

brought in by the new methods employed in 1935. Similar analysis, with allowance for trends, suggests that had the 1925 and 1930 enumerations been "normal," the total for the United States would have been around 50,000,000 acres larger in 1925, and 17,000,000 acres larger in 1930.[16] Could a really full enumeration have been taken in 1935, another 5,000,000 acres of land in farms might have been found. It would mostly have been in farms with very small acreages.

TABLE IX

PERCENTAGE CHANGES IN LAND IN FARMS BY GEOGRAPHIC DIVISIONS REPORTED BY CENSUSES SINCE 1920

Divisions	1920–25	1925–30	1930–35
New England	− 7	−10	+ 8
Middle Atlantic	− 8	− 7	+ 4
E. N. Central	− 4	− 2	+ 5
W. N. Central	− 3	+ 7	+ 3
South Atlantic	− 9	− 2	+10
E. S. Central	−11	+ 3	+ 8
W. S. Central	− 5	+10	+ 9
Mountain	+11	+16	+ 9
Pacific	− 3	+10	+ 3
United States	− 3	+ 6	+ 6

The best evidence as to incompleteness of the land enumeration even in 1935 is of the same order as that for the farm enumeration—wide variations in the amount of change in neighboring towns, amounting in many instances to differences in direction of change. The variations for New England towns are almost as striking as those given in Chart 2 for numbers of farms. They will not be as pronounced outside of the Northeast because the part-time farms elsewhere do not commonly have considerable largely unused land attached to them.

The effect of the adjustment to the 1920 "normal" upon the average size of farms in the United States might have been about as follows:

Years	1920	1925	1930	1935
Reported average	148	145	157	155
Adjusted average	148	152	153	158

The 1925 reported average was lowered both by the inclusion of more small farms than in 1920, and the omission of many large farms; the

[16] The methods used in deriving these estimates may be illustrated as follows: In many of the larger size groups in the Northeast a sharp decline in acreage was reported from 1920 to 1925, a slight recovery to 1930 and a pronounced upward trend to 1935. The assumption was made in such cases that actually the trend was downward at a uniform rate from 1920 to 1930, but that the acreage did not go as low as the 1930 census indicated and that the trend to 1935 was less sharply upward than indicated by the census data. In parts of the South where boll weevil infestation caused a considerable abandonment of farm land between 1920 and 1925, the low point was reached in 1925 with a continuous upward trend from 1925 to 1935. In such cases the effects of underenumeration in 1925 and of actual decreases could be separated only arbitrarily, about half of the change being attributed to each factor. It should be clearly understood that the results arrived at by these methods are not looked upon as estimates which could be used in correcting the reported figures, but rather as indicative of the magnitude of the error that may easily have resulted from the methods that were used.

1930 reported average was raised by the restoration of the large farms to the count and omission of a large number of small farms. The 1935 average was lowered by the addition of many more small farms than had been omitted in 1930.[17] It must be remembered that each little farm of a few acres has the same weight in the average as each large farm.

Had the count of farms in 1930 and 1935 been upon a "normal" basis, the percentage of rented farms probably would have increased slightly instead of decreasing slightly.

Professor Davis's careful study of the Connecticut enumeration indicates that the number of cows in Connecticut in 1930 was affected about the same as was land in farms.[18] There are no important reasons for thinking that the 1935 count of cattle in Connecticut and elsewhere did not follow the pattern for land in farms. Other classes of livestock were similarly affected; and likewise the acreage of most crops.

There are other deficiencies of the census of agriculture which may be fully as important as the count of farms. All of these are somewhat related to the proportion of farms enumerated. But they probably depend more upon other types of changes. This article purposely confines itself to one aspect of the problem.

COUNTING THE FARMS IN 1940

Probably late in 1939 the Bureau of the Census will begin the counting of the farms in the United States as of the date of January 1, 1940. The nation cannot afford not to do the job better than it has ever been done before. The need is so great for knowing what is happening to farms in general and in hundreds of critical areas that a vigorous effort should be made to put this next counting of farms upon a full-enumeration basis and to see that the 1945 and later censuses follow the same lines. The writers of this article believe that enough has been learned from 1935 and earlier census experience to make such a full enumeration possible in 1940, or at least near enough to it so that the omissions will not be serious in most areas. The procedures needed appear to be as follows.

I. Have the enumerators report all agricultural production of any kind whatever anywhere, and then have the classifying done in the Bureau of the Census in Washington by trained editors who follow carefully stated rules, which should be published in the census reports, and followed exactly in later censuses. This

[17] The count of farms of under 3 acres ran contrary to this; but the numbers of these were small at their most.

[18] This JOURNAL, Vol. 28, September, 1933, pp. 283–4.

procedure was begun in the 1935 census and needs only to be developed further and improved. It probably attained fully half of its objective at its first trial.

The main reason for securing a full count is not the importance of the farms and production omitted, although this is considerable, but that the variations in proportion of farms and production reported from area to area and census to census, so long as the count is not full, make uncertain all measures of change and difference. We may not want even to classify as farms a million or two of the establishments reporting some agricultural production; but it is necessary that what are called farms in 1940 will also be called farms in 1945.

II. Requiring the enumerators to report agricultural production regardless of the occupation or occupations of the family or household. It may be necessary to use the full agricultural schedule for each establishment reporting any agricultural production.

III. Making trial enumerations, before the regular enumeration, of a few score sample townships in various sections of the country, and learning from these the defects in the proposed schedule and methods of enumeration, and the difficulties to be overcome.

IV. Conducting short training schools for prospective enumerators, and eliminating in advance those without needed ability or aptitude.

V. Having the enumerators locate and number all farms or rural households on a detailed road map, these to be put in the hands of the enumerators taking the following census: requiring succeeding enumerators to account for all farms of five years before and locate any new farms. The procedure has been discussed for some years, and in general is acceptable to census administrators. Forty counties were enumerated, experimentally, on this basis in 1935. The main obstacles have been that suitable base maps have not been available for considerable sections of the country (especially in the South), and the additional work imposed upon the enumerators. But by 1940 the Bureau of Public Roads will have maps showing location of roads and farmsteads for the whole United States. The additional work imposed upon the enumerators will be no more than required to take a good census without base maps. The saving of the present system is due only to the incompleteness of the enumeration.

There are special difficulties in taking the farm census among croppers in the South which these suggestions do not altogether meet and which the writers do not consider themselves competent to analyze adequately. This is also true of some relevant features of the general population enumeration. For example, it may be advisable to have secondary occupations reported for all households whether on farms or not; and principal occupations off the farm for members of farm households. We shall never have an adequate basis for estimating national income until income from domestic or household occupations is reported for urban as well as farm families. The so-called farm population count should be made only in connection with an enumeration that includes both agriculture and population; and the classification should be made in the office and not in the field.

In the sixty years since Francis Walker undertook to give us a real census of American industry and population, some highly important advances have been made. The census administrators time after time have responded to real needs of the current situation. But a point has been reached where a major change is called for; and it does not appear that those responsible for the 1940 census have become fully aware of the circumstances. The census administrators still speak in terms of the accuracy of the totals for the nation and by states. They do not seem to realize fully that today we must have county and even township data that can be used as basis of production adjustments, land use planning and several other related purposes. If the census does not supply us with these data, it will be supplanted, and very promptly too. The 1940 census represents probably the last chance it will have to prove its adequacy for the new needs. A very nearly full enumeration of farms of all description, with careful classification by types, that will give results comparable from census to census, is an absolute need of the times, and must be met even though it adds somewhat to the cost, and upsets considerably the routine of the job. If the present Administration is as much interested in good public management as is sometimes alleged, and as it occasionally demonstrates, it will not let the 1940 census fail for lack of an adequate appropriation.

DISCUSSION

No one will question the importance of securing the best possible count of the farms, farm people, and other aspects of the national agricultural picture. Our concern, therefore, must be with efforts to devise improvements in the procedures used. Dr. Black and Dr. Allen have presented a number of contentions which if well founded are of major importance both as indicating qualifications needed in the use of census data and as indicators to be con-

sidered in planning for future enumerations. Since they have specifically disclaimed the desirability of using their conclusions for setting up correction factors, our present concern is mainly with the implications of their studies in plans for the future. Improvement must depend upon critical analyses of past censuses together with attempts to identify and appraise factors which may affect the accuracy of future enumerations. The greatest handicap to such appraisal is, of course, that of making corrections in one faulty measure by reference to other faulty measures. Only rough indicators of the variations from an ideal count are available, and even these are such that opinions of qualified investigators will differ as to the dependence which should be placed upon them. So complex is the problem of defining farming, part-time farming, farmers, farm population, agricultural lands, etc., that even trained investigators differ in their results when surveying the same universes.[1] This fact should make us cautious in accepting as ideally perfect even so careful a survey as that made by Professor I. G. Davis in Connecticut, or that of Dr. Rozman in Massachusetts, and still more cautious about generalizing these conclusions to other parts of the United States. Despite these reservations, however, there seems very good evidence that the procedure in enumeration can and should be improved in future counts.

A number of the conclusions and recommendations presented by a subcommittee of the Social Science Research Council and the American Farm Economic Association are in line with the implications of this article as to possible methods of improvement.[2] These in the main have to do with a somewhat different organization of the field work in taking agricultural censues and would look to more use of the people who are working with the Division of Crop and Livestock Estimates in the Bureau of Agricultural Economics. There has been at times, however, a too easy conclusion that if the enumeration were carried out by some other agency or with the use of a different personnel in the Bureau of the Census, this would automatically bring about a far better result. It must be recognized that no method of organization will make available for a short period and at relatively low compensation an adequate number of trained investigators to take a census either of the agriculture or the population of the United States. Even with the best organization that can be developed practically it will still be necessary to use large numbers of people who have a less than satisfactory background of experience and training. In the 1930 Census there were 120,006 enumeration districts. These were included in some 575 supervisors' districts. Such an undertaking necessitates a large field staff which must be recruited in a comparatively short period, even though the greatest of freedom prevail in their selection, and even though the leadership be the best

[1] Numerous instances could be cited in which trained investigators covering the same areas and seeking substantially similar information have secured significantly different results because of slight differences in formulation of questions, variations in coverage, etc. This merely illustrates the difficulty of finding any incontrovertible measure by which to gauge the adequacy or inadequacy of any given survey or enumeration.

[2] Report in press, to appear shortly as a bulletin of the Social Science Research Council.

obtainable. If, as has been suggested, more of the personnel could be drawn from the Department of Agriculture's Crop and Livestock Reporters, from the State Statistician's offices, and from the agricultural colleges, it seems evident that better results could be obtained though many difficulties would still remain in getting as good a count as is desired. This comment is made not in deprecation of efforts to better the situation but merely in recognition of the human problems presented by the task regardless of where the enumeration is handled or by whom supervised. It seems clear that significant improvements can be made. The end result in any event, however, will be merely as close an approach to some ideal handling of the situation as can be secured practically.

Some notion of the variety of conditions which must be dealt with can be secured not only from the situation described for New England but from other peculiarly difficult areas as, for example, those of California. In a recent study by Dr. G. M. Peterson, of the Giannini Foundation, he found in San Diego County, California, some 3,000 farms listed.[3] His study showed about 4,000 properties of three acres and over outside city limits which were tax delinquent at the time of making the survey. Further investigation developed the fact that there were in SanDiego County alone approximately 16,000 tracts of three acres and over in individual ownership and outside city limits. Under census definition these would not be classed as farms unless a domicile of some kind had been constructed on them. The great majority of them are not farms in the sense that we ordinarily think of farms, even though they may have houses on them. They are in the main suburban homesites. The problem of drawing a clear distinction in such a situation is, of course, a very difficult one. In another area in central California large numbers of small tracts planted to fig trees and other fruits have been sold to individuals but are not operated by these individuals, at least in the early years of ownership. Operation is carried on by the selling company under contract with the owner. Many of these have incomes which would place them in the farming class in the minds of most people, yet it is very difficult to frame a definition which will differentiate individual farms under such conditions. A different but equally difficult situation is mentioned by Black and Allen, namely the problem of drawing a line between the Southern cropper and the hired laborer on the Southern plantation. Another type of problem which has given rise to difficulty in enumeration has come about as a result of depression conditions. Numerous farm properties were rented during properous times to operators who did not own them. Several of these might under these conditions appear as one farm, in the ordinary process of enumeration. With the onset of depression, however, many of these owners took up residence on such properties and became farm operators. These same enterprises then became not one farm but several farms under census definition. Hundreds of similar problems can be pointed out in nearly every section of the United States. These situations exemplify the inherent diffi-

[3] From unpublished material dealing with rural tax delinquency in California.

culty of arriving at a satisfactory basis for classifying farms and farm people. They point to the urgent need for further and very careful study of possibilities of more accurate definition.

In reading the discussion by Black and Allen one is impressed by the fact that we are after all dealing with these dynamic situations in which minor and major adjustments are continually occurring. There are some dangers in assuming that adjacent areas which appear superficially to be affected by the same sets of factors are actually being thus uniformly influenced. Very careful appraisals of the actual changes occurring are necessary if conclusions are to be depended upon. It seems probable that uniformity or nonuniformity in conditions of this kind have been more carefully appraised in such intimate studies as those made by Professor I. G. Davis, Dr. Rozman, and others, than any mere statistical approach to other areas in the country could provide.

Attention has been called from time to time to the danger in assuming that totals secured in response to given questions represent actual changes in the situation. This has been well illustrated in some of the questions on land utilization where we get, for example, large increases or decreases in such items as "woodland used for pasture" or "woodland not used for pasture." A similar danger exists, however, in assuming that the changes indicated actually did not occur. It is possible that some of the changes indicated for such states as Maine might be found explainable, in part, in terms other than inadequacy of coverage as implied in the analysis by Black and Allen. If the approach were made in terms of trying to find explanations for the changes indicated by census data, we might come out with a different set of conclusions than if we sought to explain the differences as being due to over- or undercoverage by enumerators. This is not meant to challenge the fact, seemingly fairly well established, that there has been significant variation in coverage in the last three or four census enumerations. It does seem possible, however, that a part of the variation shown actually did occur, perhaps even a larger part than Black and Allen have concluded, since we have been dealing with a very dynamic period in which many factors as yet not clearly recognized have been at work affecting the operations and residence of people in relation to farm lands. For example, it is easy to assume that if the farm operator works more than 150 days off the farm, the farm may be considered as a part-time farm. It will be found, however, that a substantial number of farm managers do work more than 150 days off the farm. Yet a farm large enough to have a hired manager is almost certain to be a rather substantial commercial enterprise. Many such situations are to be found in the Western and Southern states. Changes in employment conditions which would place given farmers in the class of more than 150 days or less than 150 days may easily have occurred during the past few years without affecting substantially the true classification of these individuals. For example, a man working at a given occupation may have had during 1928, 1929, and 1930 more than 150 days work off the farm. During the depression period this same man may have operated much as before but

have had only 100 days work off the farm. Many others confronted with a decrease in the amount of available work off the farm have turned to larger production on the land controlled by them. These farms have changed in a certain intangible way but one which is extremely difficult to define.

One of the most mischievous features of the common usage of numbers of farms is in averaging, for all farms of the United States, production, farm income, etc., thus throwing into one general average the commercial farms of the country, together with hundreds of thousands of very small units which are much more in the nature of residences than of farms. Many of these are occupied by semi-retired people or people who have passed the period of active life; many are operated as side lines by people whose important source of income is from off the farm. If, then, these are included with the others in getting at average farm income, we get the same distortions that appear in averaging any group of exceedingly diverse items. It is possible that some more satisfactory definition or definitions can be devised under which farms that are clearly of small commercial importance will be designated in some separate category. As yet, however, no satisfactory differentiation along these lines has been devised. Much of the difficulty would, of course, be lessened if users of census data were more aware of the qualifications needed in computing averages and other generalized measures. The proposal made by Black and Allen that enumerators undertake to cover all enterprises which have any significant agricultural production and that carefully defined classifications be made of these by experienced census officials seems a very constructive suggestion. As pointed out in their article, some progress in this direction was made in the Census of 1935. There is need, however, for a better defining and publication of the bases on which such classifications are made.

The problem of enumeration presents two phases which are somewhat difficult to reconcile with each other. The first of these is a desire to get complete coverage. Certainly an enumeration which does not cover with substantial completeness the whole universe is unsatisfactory from almost any point of view. The other problem is that of maintaining comparability as between succeeding enumerations. This issue becomes a very important one at every census period when schedules are being prepared and plans for field organization are being shaped. Probably even more important than complete coverage is the requirement that the census enumerations indicate accurately the changes that are occurring. We are much more interested in the dynamics of the situation than in a completely accurate delineation of conditions as of a given time. For all properties which are clearly and generally accepted as being agricultural enterprises, this does not raise any question about the desirability of full coverage. It does present some difficulties with respect to complete inclusion, down to a very low minimum, of properties that are on the borderline as between mere residences and agricultural enterprises, at least if these are to be called farms and averaged in with the other farms of the nation. It is in this borderline group that great numbers of enterprises are so near the margin of being classed one way or the other that

intensive efforts to secure complete coverage may result in serious difficulty of maintaining comparability even with relatively good enumeration procedure. Certain of the suggestions made by Black and Allen point to improvements which would help in clarifying definitions in these groups, particularly the proposal to take into account changes in general price level in using total value of product as a criterion. Even this, however, will not prevent entirely the inclusion in some censuses of given enterprises and the exclusion in other censuses of these same enterprises, thus damaging to some extent the comparability of the two counts.

It is evident that these problems should be thoroughly thrashed out prior to the Census of 1940 with a view to getting sufficient agreement both on procedure and definitions that these can be maintained virtually without change in succeeding enumerations. Only in such a way can comparability be established such that we shall have a reasonably adequate basis for recognizing the changes which actually occur. Even with the best procedure that can be devised in this connection it is probable that such aspects as changes in part-time farming and the significance of these in changing the sociological pattern of human endeavor will have to be based on special studies in given localities. Such definitions as have been mentioned above will inevitably have to be somewhat empirical and will be subject to difficulties through distortions which occur in applying them to widely different conditions. This appears to be an inevitable limitation of handling any classification on a national basis.

Despite such reservations as have been mentioned there seems reason to agree in the main with the conclusions drawn by the writers of this article. It seems probable that there were significant variations in the coverage in the 1925, 1930, and 1935 farm censuses. Steps taken to meet this difficulty in the 1935 Census appear to have been in the right direction, though not as yet carried far enough. There is substantial agreement on proposals I, II, III, and IV as indicated by these authors. With respct to V there is entire agreement about the desirability of more adequate mapping. Possibly other procedures may hold more promise than that indicated in this article. Very large areas of the United States are now being covered by aerial surveys conducted by a number of different agencies. There is considerable interest in standardization of aerial mapping, and this may be one of the most promising developments for securing more complete enumeration. It will not, however, meet all of the problem of dealing with borderline small farms especially in the vicinity of large cities.

One of the major defects in the present census procedure appears to be a lack of sufficient continuity in organization and personnel in the field staff. Proposals concerning this have been made by the subcommittee mentioned above. These or similar modifications of present organization and procedure would apparently help materially in securing a better count of the farms of the United States.

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Professor Benedict accepts the findings of our study except for three "reservations" as to the extent of error in existing census data; and the recommendations as to future census procedure except for supplementing them upon three points. The latter first. As to air mapping, we agree that it has been so developed in the last year or two as to prove a useful supplement to the base maps now being prepared by the Bureau of Public Roads, especially in the matter of enumerating land use. We chose to emphasize the Public Roads base maps because they alone permit a large advance in procedure, and they are likely to be everywhere available by 1940. It would be highly desirable if air mapping could accompany the 1940 census. It is highly probable that the 1950 census will include such mapping. The first census that includes such mapping will give data on land use that will not be closely comparable with those of any previous census. The nearer to such a procedure we can get in 1940, the nearer we will get to the desired goal.

As to selection of enumerators, it is perhaps not so important to use experienced workers now doing crop reporting and the like as Professor Benedict implies. The emphasis should be more upon selecting intelligent, fairly well educated persons as enumerators, training them for the specific job, and then using them in census after census, as would become more possible with more annual surveys and sample censuses. Such men will commonly be easier to train for the task than persons already experienced in crop reporting, survey taking, and the like, because they do not have so much to unlearn. The attitudes and objectives of crop reporters, for example, do not altogether fit the job of census taking.

Professor Benedict seems fearful that a complete coverage by the method we propose may affect the comparability of the results. We fail to see how this can be a serious problem as between future censuses, if the census officials devise proper principles and bases of classification to be applied to the schedules brought in. It is true that considerable variation will occur at the lowest margin of inclusion; but this will affect the data only for the bottom group, those for all the others being protected thereby.

Now as to the reservations about the findings. If our statements concerning Professor Davis's results seem to carry the implications that we accept them "as ideally perfect," this is merely a defect in exposition. In fact, we have compared Professor Davis's data with the census data town by town and census by census, until we have satisfied ourselves as to about what part of the deviations are due to differences in definition and what part to differences in enumeration. We might have included some of our own detailed analyses except for lack of space and except for not wanting to anticipate publication by Professor Davis. None of the enumerations is perfect, but our study leaves us with no doubt that Professor Davis's enumeration is more nearly correct.

As for other parts of New England, we of course agree that differences in conditions in adjoining towns can cause an increase in one and none or even a decrease in another. But this is not likely to be frequently the case, as

would appear from our mapping of census changes. Furthermore, a great deal of detailed town-by-town analysis of changes in agriculture and land use, accompanied by no small amount of field observation, over the past seven years while we have been engaged in a study of the land and agricultural economy of New England, has given us a pattern of areas of uniformity of change according to topography, soil type and location with which the census reports of change are only partly consistent.

Professor Benedict suggests that the proper approach in studying this problem is to assume that the census reports of change are correct and to look for another explanation only when necessary. That, of course, is exactly what was done in this case. For three years the senior author struggled with the available census data upon New England agriculture and land use, trying to derive from them a consistent account and explanation of change, before deciding to inquire into the nature of the data and the census procedure. This led him into similar studies of change in relation to census data in other regions. The striking parallels found in other Northeastern states and in certain other sections reinforced his conclusions as to the New England census data. It is entirely possible, of course, that we have assigned too much of the change in reported data outside of the Northeast to variations in census procedure, and not enough to the "dynamics" of the period. We offer only a judgment on this point; but it is based upon more examination of census data in relation to other data, more consultation with other users of census data, and more interviews with research workers in different areas, than almost any judgment that has been made. Both of the authors have done considerable research work in some other sections of the country, notably the Great Lakes states and California.

Professor Benedict writes of the need of refined studies as a basis for the 1940 census. Indeed this would be desirable. The senior author has labored for three years to get such studies under way with the Social Science Research Council, with the Committee on Government Statistics and Information Services, and with the census officials themselves. And now the plans of the 1940 census are nearly complete. A tentative schedule has already been agreed upon among the Washington bureaucrats. The plans do not include the complete coverage of agricultural production urged in this article, and some other of the recommendations. Even Professor Benedict's innocent comments will unfortunately be used by census officials as reasons for not accepting these recommendations.

JOHN D. BLACK
R. H. ALLEN

VARIATIONS AMONG CITIES IN PER CAPITA INCOME

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Cities obviously differ in the per capita income of their residents. These differences are important in connection with many features of their public and private activities. This article will report methods of measuring, or at least estimating closely, the relative status of cities in the United States of 25,000 and over in respect of income at or near 1930 by using facts of record concerning 117 cities for 20 items of income or expenditure. It will also present certain facts concerning the significance of variations among cities in per capita income.

A true or perfect measure of the private income of a city is obviously the sum of the incomes of its citizens or inhabitants. This being impossible to obtain, one might use (a) the reported incomes of those reporting to the Federal government and (b) the wages (observed, taken from testimony, or estimated) for the rest. But the former are not revealed and the latter would require very great labor and expense for even rough estimates. So we can only estimate income from items which are related to income partially or deviously, and may be dependent upon other features of a city than the income of its residents.

This report suffers from four other limitations. It concerns dollar incomes with no allowance for differences in the value of money in the cities in question. It concerns, not absolute incomes in dollars per capita, but only relative incomes or indices which will rank the cities more or less accurately as their absolute per capita incomes would rank them if the latter were known. It concerns incomes for a period of several years centering about the year 1930. How stable the results are can be determined only when comparable data are again available, presumably in the next census. It concerns only 117 cities of the 310 which could have been used. They are, however, a fair sample for our problem.

What I have done is to take such facts as would presumably show a positive correlation with the true or perfect measures of the per capita income of the community or of some large group of its population, and treat them reasonably. The intercorrelations of these possible symptoms of income are themselves instructive.

The items below were chosen from about two hundred which I have collected for most cities of 25,000 or over. Some (e.g., number of income-tax returns) concern directly the incomes of the relatively wealthy; some (e.g., 5-percentile rental) concern the incomes of the very poor; some (e.g., wages of employees in retail stores) concern incomes of the so-called lower middle classes. From the many statistics of retail sales available those were chosen which seemed likely to correlate most closely with the expenditures of a city's residents.

Identification number	*Item*
1.	Approximate number of income-tax returns per capita. The number reported in U. S. Treasury Publication, No. 2108 for 1933, divided by the 1930 population.*
2.	Approximate number of income-tax returns in 1926 reporting $5,000 or over. Computed pro rata from data for counties as given in *National Markets and National Advertising.*
3.	Income as estimated in *Markets and Quotas*, Curtis Publishing Co., 1932, divided by the 1930 population to give a per capita estimate.
4.	"Total income" as estimated for 1926 in *National Markets and National Advertising*, Advertising Department of the Crowell Publishing Co., 1927, divided by the geometric mean of the 1920 and 1930 populations.
5.	"Marginal income" as estimated for 1926 (same source as Items 3 and 4) divided by the geometric mean of the 1920 and 1930 populations.
6.	Average (with approximately equal weight) of the average salary of elementary-school teachers and the average salary of high-school teachers. Computed from data in the *Biennial Survey of Education*, 1928–1930, U. S. Department of the Interior, Office of Education, Vol. II, pp. 142 f. and 251 f.
7.	Average salary of full-time employees in retail stores. *U. S. Census of Distribution for 1930*, Volumes 2 and 3.
8.	Average wage of full-time employees in manufacturing plants. Average for 1929 and 1931. Computed from data in the supplements to the *1933 Biennial Census of Manufactures.*
9.	Per capita bank deposits. Computed from data given in *Markets and Quotas*, Curtis Publishing Co., 1932.
10.	Per capita expenditures for the support of churches in 1920. Computed from data in Tables 30 and 31 of *Religious Bodies, 1926*, U. S. Census.
11.	Per capita value of sales of all retail stores. Computed from data in *U. S. Census of Distribution for 1930*, Volume 1.
12.	Per capita value of sales of food. Same source as for Item 11.
13.	Per capita value of sales of cigar stores. Same source as for Item 11.
14.	Per capita value of sales of drug stores. Same source as for Item 11.

* By inadvertence the income-tax scores for 1933 were used instead of those for the average of 1930 and 1931. Since the differences are small and "accidental" (the correlation between the two sets is .84) I did not recompute the correlations and indices. The changes would be very slight in the former and inappreciable in the latter.

Identification number — *Item*

15. Per capita circulation of fifteen leading magazines. The circulations are as reported in *Circulation of Fifteen Leading Magazines* by the Marketing Division of the International Magazine Company. The 1930 populations are used as divisors.
16. Per capita circulation (approximate) of Modern Screen, Radio Stars, and Modern Romances. Data from *Modern Magazines* for 1935 divided by 1930 population.
17. Per capita value of building permits for private garages. Computed from the data in Bulletin 545 of the U. S. Bureau of Labor Statistics, *Building Permits in the Principal Cities of the U. S. in 1930.*
18. Per capita number of automobiles. The sum of the numbers reported for Fords and cars other than Fords in *Markets and Quotas*, Curtis Publishing Co., 1932, divided by the 1930 population.
19. Estimated average family rental. Computed from data in the 1930 Census, *Statistics of Population*, Vol. 6, Tables 7 and 21 for each state.
20. Rarity of extreme poverty, measured by the rent paid (or equivalent if the home is owned) by the 5th percentile family (i.e., the rental less than which is paid by 5 per cent and more than which is paid by 95 per cent of the community's families). Same source as for Item 19.

Items 3, 4 and 5 are of unknown composition and may contain factors desirable from the advertiser's point of view, but not from ours. We shall in fact not use them in our final indices. Items 11, 12, 13 and 14, reporting the sales of retail stores in the city (total, food, cigar stores and drug stores) are disturbed by the fact that in suburban cities (such as Cambridge, Newton and Somerville), the residents buy much from the big city whose suburbs they are, and by the fact that in trading centers (such as Lexington, Kentucky, or the three Springfields), the retail stores sell much to non-residents. Item 9 (bank deposits) is subject to the same sort of disturbance.

Expenditures for churches (10) and for the fifteen well-known periodicals (15) indicate the incomes of church supporters and readers of "good" magazines. We lack items of expenditures for prostitutes, gambling, etc., as supplements and correctives. The expense for rental (Item 19) is also subject to moral limitations. A given expense for a home, say of $300 per year, may be a quarter of the income of men devoted to home and family or an eighth of the income of men devoted to more sensual and exciting pleasures.

The original data are marred for our purpose by certain inadequacies and defects. "Bank deposits" are a mixture of savings and check accounts; "Income-tax returns" are as described on page 18 f. of *Statistics of Income for 1930;* "Church expenditures" do not include all the churches in the city. These are the worst defects, but probably no

item is impeccable. We can only hope that the errors act largely at random, so that a composite of many items will be fairly near the truth.

In certain cities the per capita income is a composite of incomes of white and negro families, and in all cities it is a composite of incomes of families heterogeneous in many respects. It would be useful to repeat this entire study with allowances for the age-distribution and other variables in each city.

It will be desirable eventually to study variation in income among special groups of cities, such as trading centers and suburbs, manufacturing, mining, and white-collar communities, north and south, large and small, etc. But it seemed best first to include a wide range of varieties, partly to have a large enough group to work with, and partly to gain information about the difficulties arising from heterogeneity. So I have used those cities which had populations of from 25,000 to 90,000 in 1900.[1] Some are now ten times as large as others; they are scattered all over the country; they include suburbs, trading centers, mining cities, etc. I did not even exclude Atlantic City, a resort-city in which the sales of cigar-stores, for example, would give an utterly fantastic measure of the income of the resident population.

Let us examine the facts regardless of all these disturbing factors except if, when, and as they influence some conclusion.

The first set of facts comprises the intercorrelations of the items shown in Table I. These are all computed by Sheppard's formula ($r = \cos \pi U$ where U is the percentage of unlike-signed pairs), counting cases of $+0$, $0+$, -0, $0-$, and 00 as follows: one fourth of them were counted as like-signed; one fourth of them were counted as unlike-signed; one half of them were divided between like-signed and unlike-signed in the same proportions as held for the pairs involving no zeros. This minimizes the influence of skewness and extreme cases in the distribution of any item.

I include also in Table I the correlations with a weighted composite of number of homes owned (per capita), persons graduating from high school in 1934 (per capita), ratio of the outside benevolences of the churches to their expenditures for their own preacher, choir, etc., and the excess of physicians, nurses and teachers over male domestic servants in the city's population. I shall call this composite score P.Q. since it seems to be an indication of certain personal qualities in the population. It will be of great service in interpreting expenditures as symptoms of income. Evidence which I lack space to present shows

[1] Less three for which 1930 data are not available, because they have been absorbed or are now too small.

that the P.Q. of a city is only slightly related to its income or tax receipts, but rather closely related to how it spends each of these.

Study of Table I shows that the items are more or less "constellated." The income-tax data and the commercial estimates of income correlate *inter se* from .57 to .81. If we leave out the Curtis estimate (Item 3) the other four correlate low with all other items, and not at

TABLE I

CORRELATIONS

The intercorrelations of various measures which are presumably indicative of the relative amounts of private income of cities; and the correlations of each measure with a composite (P.Q.) indicative of certain qualities in the population. *Decimal points are omitted.*

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	—	61	79	57	66	29	48	17	64	29	51	50	40	07	37	50	36	−03	38	37
2	61	—	62	75	81	19	34	08	24	47	34	23	14	28	36	43	34	04	52	49
3	79	62	—	58	59	56	61	55	43	51	64	52	36	14	50	44	54	25	17	59
4	57	75	58	—	71	18	27	19	32	67	39	32	10	12	36	32	29	16	53	49
5	66	81	59	71	—	39	46	04	53	45	08	43	19	−32	20	51	47	−25	64	73
6	29	19	56	18	39	—	67	69	33	−14	−01	39	17	−37	00	21	26	01	61	59
7	48	34	61	27	46	67	—	60	24	−08	28	63	42	−19	23	40	43	08	65	71
8	17	08	55	19	04	69	60	—	−09	01	38	41	50	13	40	17	38	50	66	58
9	64	24	43	32	53	33	24	−09	—	03	10	28	25	−30	13	36	08	−13	25	20
10	29	47	51	67	45	−14	−08	01	03	—	51	−10	−11	27	36	38	37	33	39	30
11	51	34	64	39	08	−01	28	38	10	51	—	43	38	48	75	45	31	68	36	21
12	50	23	52	32	43	39	63	41	28	−10	43	—	48	−19	24	36	38	06	54	48
13	40	14	36	10	19	17	42	50	25	−11	38	48	—	01	44	54	34	27	51	38
14	07	28	14	12	−32	−37	−19	13	−30	27	48	−19	01	—	44	−01	−07	42	−19	−29
15	37	36	50	36	20	00	23	40	13	36	75	24	44	44	—	32	21	71	37	13
16	50	43	44	32	51	21	40	17	36	38	45	36	54	−01	32	—	58	07	55	54
17	36	34	54	29	47	26	43	38	08	37	31	38	34	−07	21	58	—	14	71	69
18	−03	04	25	16	−25	01	08	50	−13	33	68	06	27	42	71	07	14	—	19	16
19	38	52	71	53	64	61	65	66	25	39	36	54	51	−19	37	55	71	19	—	94
20	37	49	59	49	73	59	71	58	20	30	21	48	38	−29	13	54	69	16	94	—
P.Q.	−10	−14	09	−06	−27	−07	13	25	−18	24	63	32	02	04	58	18	27	65	22	00

all with P.Q.[2] The salary and wage data (Items 6, 7 and 8) correlate *inter se* .67, .56, and .66, and correlate low with bank deposits, church, magazines, total retail sales, and drugs, and low with P.Q. Ownership of automobiles (18), general magazines (15), and total retail sales (11) correlate *inter se* .71, .68, and .75, and very high with P.Q. (.65, .58, and .63). The average expenditure for rent and the expenditure of the 5-percentile family, intercorrelate .94, and correlate high (.58 to .66) with the salary and wage items, and low with P.Q. (.22).

Since the commercial estimates are of undescribed constitution and may not be published in the future, it is best to get an income index without using them if that can be done with no substantial sacrifice. Guided by the facts of Table I we compute certain correlations between a composite of the three commercial estimates (3, 4, and 5 with

[2] The Curtis estimate is weighted with whatever causes expenses for good magazines, and for rent, and has kinship with P.Q. These features may improve it for the purposes for which it was designed.

respective weights of approximately 1, 2/3 and 1 respectively) and some of our other measures. The results (presented in column A of Table II), especially the correlation of .86 with an income-tax composite, show that we can dispense with them.

Since our expenditure items are already weighted in favor of reputable expenditures, we will do well to keep our index free of Items 15 (fifteen magazines), 11 (total retail sales), and 18 (automobiles) which all correlate high with P.Q.

Income-tax data we must, of course, keep, and the salary and wage data. To supplement these we need especially some items correlated with the incomes of the very poor. Item 20 (rental of the 5-percentile family) will serve this purpose, either by itself or as included in item 19 (average rental) in which it has suitable weight and with which it correlates .94. Sales of retail food-stores serves the same purpose, since so large a fraction of the incomes of the poor must be spent for food. Bank deposits, church expenditures and cigar and drug stores presumably deserve some weight.

Items 100 (Modern Screen, etc.) and 125 (private garages) are excluded because they are probably unnecessary and may not be available in future years.

A composite of Items 9, 10, 12, 13, and 14 (bank deposits, church support, and retail sales of food, cigar and drug stores) with weights of approximately 1, 1, 2/3, 2/5 and 2/5 respectively, has correlations as shown in Column D of Table II.

TABLE II

INTERCORRELATIONS OF VARIOUS COMPOSITE MEASURES

	A	B	C	D	E	F
A. Commercial estimates of income	—	.86	.41	.61	.71	−.10
B. Income tax returns	.86	—	.16	.52	.55	−.10
C. Salaries and wages	.41	.16	—	.15	.62	.17
D. Bank deposits, church, food, cigar and drug store sales	.61	.52	.15	—	.63	.13
E. Average rental	.71	.55	.62	.63	—	.22
F. P.Q. (home ownership, high school graduation, benevolence, etc.)	−.10	−.10	.17	.13	.22	—

I propose therefore as an index of the per capita private income of a city a composite of the following. For the weights I have used, any others that seem better can be substituted.

Item	*Weight*
1. The number of income tax returns	5
2. The number of income tax returns over $5,000	5
6. Average of average salary of elementary school teachers and average salary of high school teachers	2½
7. Average salary of full time employees of retail stores	2
8. Average wage of workers in manufacturing plants	3
9. Bank deposits	2½

Item	*Weight*
10. Current expenditures for churches	2
12. Sales of retail food stores	3½
13. Sales of retail cigar stores	1
14. Sales of retail drug stores	1
19. Average family rental (or equivalent in case of owned homes)	4

My weighting gives approximately equal weight to the income-tax data and the salary-wage data, and about 1 1/5 times as much to these together as to the data from expenditures and bank deposits. In the latter, rent and food store sales have about equal weight, and together as much as all the others.

That the resulting index has some value may be seen by noting which of the 117 cities it puts at the top and which at the bottom. By it the five highest are Newton, Atlantic City, Yonkers, Hartford, and Oakland. The five lowest are Augusta (Ga.), Charleston (S.C.), Montgomery, Savannah, and Kansas City (Kan.).

I report in Table III the score of each of the 117 cities so that anybody may check the index in any way that seems desirable. I report also the score of each city by two different combinations of Items, Index IB and Index IC. Index IB omits Items 7 and 8 but adds Item 20 (5-percentile rental) and Item 17 (building of private garages). The weights in Index IB are as follows: 1, 5; 2, 5; 6, 5; 9, 2½; 10, 3; 12, 3½; 13, 2; 14, 2; 17, 1½; 19, 5½; 20, 4. Index IC is the same as IB except that Items 13, 17, and 19 are omitted.

It will be observed that these substantial changes in the elements do not greatly alter the ranking of the cities. The correlations between the three indices are: I_A with I_B, .93; I_A with I_C, .88; I_B with I_C, .98.

An accurate census of the actual incomes of the residents of fifty or more selected cities would test the validity of these scores. If they are found valuable, this same census (or a more extensive one) could be used to compute absolute dollar incomes from the relative scores by this index. It is at least good enough to make its correlations instructive. Some of them are as follows:

I. With the per capita value of property subject to taxation in these cities (computed by using the reported assessed valuation and reported rate of assessed to real value for each city in 1930) $r = .44$.

II. With the "personal qualities" composite of scores for home owning, graduation from high school, ratio of outside benevolences to expenditures for local churches, and excess of physicians, nurses and teachers over male domestic servants, $r = .08$.

III. With a composite of the per capita numbers of telephones and of domestic installations of gas and of electricity, $r = .37$. The correla-

tion of the "personal qualities" composite with the gas, electricity, and telephone composite is .57. Since the correlation of I with the "personal qualities" composite is only .08, we can conclude that the frequency of use of gas, electricity, and telephones in a city is a better

TABLE III

SCORES OF CITIES IN PER CAPITA INCOME BY THREE INDICES

	A	B	C
Alabama			
Birmingham	−5	−8	−3
Mobile	−10	−11	−5
Montgomery	−11	−12	−6
Arkansas			
Little Rock	−5	−6	−2
California			
Oakland	10	10	8
Sacramento	8	6	6
Colorado			
Pueblo	−9	−13	−9
Connecticut			
Bridgeport	2	1	2
Hartford	14	15	14
New Britain	0	−2	−2
Waterbury	3	2	2
Delaware			
Wilmington	8	10	7
Florida			
Jacksonville	−5	−5	−1
Georgia			
Atlanta	−2	−2	−2
Augusta	−15	−15	−9
Savannah	−11	−10	−5
Illinois			
East St. Louis	−5	−8	−5
Joliet	9	9	6
Peoria	0	2	3
Quincy	−6	−5	−2
Rockford	2	2	−1
Springfield	0	0	1
Indiana			
Evansville	−7	−8	−4
Fort Wayne	2	3	3
South Bend	1	1	0
Terre Haute	−4	−5	−2
Iowa			
Cedar Rapids	−2	−2	−1
Council Bluffs	−6	−10	−6
Davenport	0	0	1
Des Moines	1	0	3
Dubuque	−5	−5	−3
Sioux City	−3	−4	−2
Kansas			
Kansas City	−10	−13	−7
Topeka	0	−2	0
Kentucky			
Covington	0	−3	−2
Lexington	4	2	3
Maine			
Portland	4	4	4
Massachusetts			
Brockton	1	0	1
Cambridge	9	9	7
Chelsea	−4	−5	−3
Fitchburg	−3	−3	0
Haverhill	−2	4	−1
Holyoke	2	3	3
Lawrence	−3	−4	−1
Lynn	3	4	3
Malden	2	4	4
New Bedford	−6	−5	−3
Newton	31	37	28
Salem	3	4	4
Somerville	5	3	3
Springfield	7	7	6
Taunton	−7	−8	−6
Michigan			
Bay City	−8	−9	−5
Grand Rapids	6	7	5
Jackson	0	0	0
Saginaw	−2	−5	−3
Minnesota			
Duluth	−1	−2	0
Missouri			
Joplin	−8	−12	−7
Montana			
Butte	5	−3	−1
Nebraska			
Lincoln	0	−1	0
N. H.			
Manchester	−6	−7	−4
N. J.			
Atlantic City	19	25	17
Bayonne	2	1	2
Camden	−4	−4	−2
Elizabeth	3	0	−3
Hoboken	9	9	8
Passaic	3	2	−1
Trenton	5	6	6
N. Y.			
Auburn	0	1	1
Binghamton	2	4	3
Elmira	3	2	2
Schenectady	7	8	5
Troy	1	1	2
Utica	3	4	4
Yonkers	18	20	13
Ohio			
Akron	−5	−1	−2
Canton	6	4	1
Dayton	3	−2	3
Springfield	−4	−6	−5
Youngstown	1	−2	−1
Oregon			
Portland	2	1	2
Pennsylvania			
Allentown	2	5	1
Altoona	−4	1	2
Chester	1	−1	0
Easton	9	9	7
Erie	1	1	1
Harrisburg	4	6	6
Johnstown	−1	−3	−2
Lancaster	3	5	6
McKeesport	5	6	3
Newcastle	−2	−1	0
Reading	2	3	2
Wilkes-Barre	2	3	3
Williamsport	1	2	3
York	1	3	5
R. I.			
Pawtucket	−2	0	0
Woonsocket	−3	−3	−2
S. Carolina			
Charleston	−12	−12	−5
Tenn.			
Chattanooga	−5	−6	−2
Knoxville	−7	−7	−2
Nashville	−4	−6	−2
Texas			
Dallas	4	3	6
Fort Worth	−4	−5	−2
Galveston	−1	−2	1
Houston	3	2	4
San Antonio	−7	−8	−3
Utah			
Salt Lake City	−1	−4	0
Virginia			
Norfolk	−5	−6	−3
Richmond	1	1	3
Washington			
Seattle	7	5	6
Spokane	−2	−5	−1
Tacoma	−3	−5	−2
W. Va.			
Wheeling	8	7	8
Wisconsin			
La Crosse	−3	−4	−2
Oshkosh	−4	−2	−1
Racine	3	3	−1
Superior	−6	−7	−4

index of its populace than of their per capita income, and is a poor index of the latter.

IV. With the percentage of persons 16 or 17 years of age attending schools, $r = -.13$.

V. With a composite of per capita public expenditures in 1930 for teachers' salaries, textbooks and supplies, libraries and museums and recreation, $r = .52$.

VI. With a composite of per capita public expenditures for high-

ways, light, sanitation, general government, police, fire department, health and public safety, $r = .43$.

The correlations of the "personal qualities" composite with the items of IV, V, and VI are very different from those of I. They are .56, .24, and −.33. The −.13 and .56 for IV offer impressive evidence of the fact that the way the citizens spend their income counts more in certain important matters than the amount they have to spend. The .52 and .24 for V in conjunction with the .43 and −.33 for VI are further evidence of this, complicated, however, by possible influence of the cost of living.

It would be possible to compute correlations showing the significance of differences between cities in private income for many other features of the cities in question. But it seems best to defer this until the facts presented in the paper have been supplemented by data from all cities of 25,000 or over, and until the correlations have been computed for less heterogeneous groups of cities.

OUTLINE OF 1936 MORTALITY AND NATALITY TABULATIONS MADE BY THE BUREAU OF THE CENSUS

By Forrest E. Linder
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The principal vital statistics tabulations made by the Bureau of the Census are published annually in *Mortality Statistics; Birth, Stillbirth, and Infant Mortality Statistics;* or in *Vital Statistics—Special Reports.* These published tables are consolidations and condensations of more detailed, printed machine tabulations. The unpublished data constitute a valuable source of material which is available to the serious student of vital statistics. Files in the Division of Vital Statistics contain voluminous unpublished mortality tabulations dating back to 1900, and natality tabulations dating back to 1915. While the Bureau of the Census cannot supply unlimited compilations from these files, every possible effort is made to meet the needs of those desiring such material. With the ultimate extension of microphotographic methods of preserving data, it may be possible to supply film copies of complete sets of tabulations at a nominal cost.

One of the principal obstacles to the full utilization of such extensive statistical material collected by various governmental agencies, is the fact that the nature and extent of such data is not well known to those outside each particular collecting agency. The desirability of detailed indices which would facilitate the use of such material cannot be overemphasized. The outlines given here are intended to summarize the specifications for each of the machine tabulations now being made by the Bureau of the Census of 1936 mortality and natality data.

All vital statistics tabulations by the Bureau of the Census are based on birth and death certificates, transcripts of which are obtained from the various state and city public health offices where the original certificates are permanently filed. In 1936 the Bureau received transcripts for approximately 1,475,000 deaths, 2,136,000 births, and 74,000 stillbirths. Each of these individual records is put through a series of coding processes whereby the written information is translated into numerical codes. This coded information is then transferred to a standard 45-column tabulation punch card. Detailed instructions regulating all coding and punching procedures are given in the official 1936 *Instruction Manual* prepared by the Division of Vital Statistics. A limited

number of *Instruction Manuals* are still available for free distribution to professional persons.

Figures 1 and 2 are reproductions of the 1936 mortality and natality cards. Below each card is a brief description of the information punched in the various fields. Machine tabulations from these cards are made, not on commercial tabulating machines, but on the census "unit counter" machine. A description of these machines, as used in the 1930 Population Census, has been published by Dr. Leon E. Truesdell.[1] The unit counter does not, like the commercial machine, add up amounts represented by holes punched in the cards, but rather counts the number of instances (in this case births or deaths) for specified classifications, for example, the number of deaths of males under five years of age. A clear understanding of the nature of the resulting tabulations can be had by considering the tabulation to be composed of two parts. The first part may be termed the "sort" and the second part the "machine count." The cards are first divided into a number of groups by a sorting machine. Each group is then run through the unit counter and the number of instances in specified classifications is counted and recorded.

The printed record of the tabulation is made on standard census machine slips. These machine slips are printed forms of three to six "decks," each deck consisting of 10 columns of tabulation. The groups into which the cards have been sorted are indicated on the stub of the first deck, whereas the column headings show the calssifications for which counts are made. The following decks may be considered as horizontal extensions of the first deck, since they contain only additional columns of machine counts. Figure 3 is a reproduction of one machine slip for Mortality Tabulation No. 2. This reproduction shows the first deck and the column headings for the remaining decks. The "sort" and consequently the detail of the side stub is the same for all decks.

The birth and death transcripts and the tabulation punch cards used in making the tabulations are not preserved, but the printed machine slips are permanently filed.

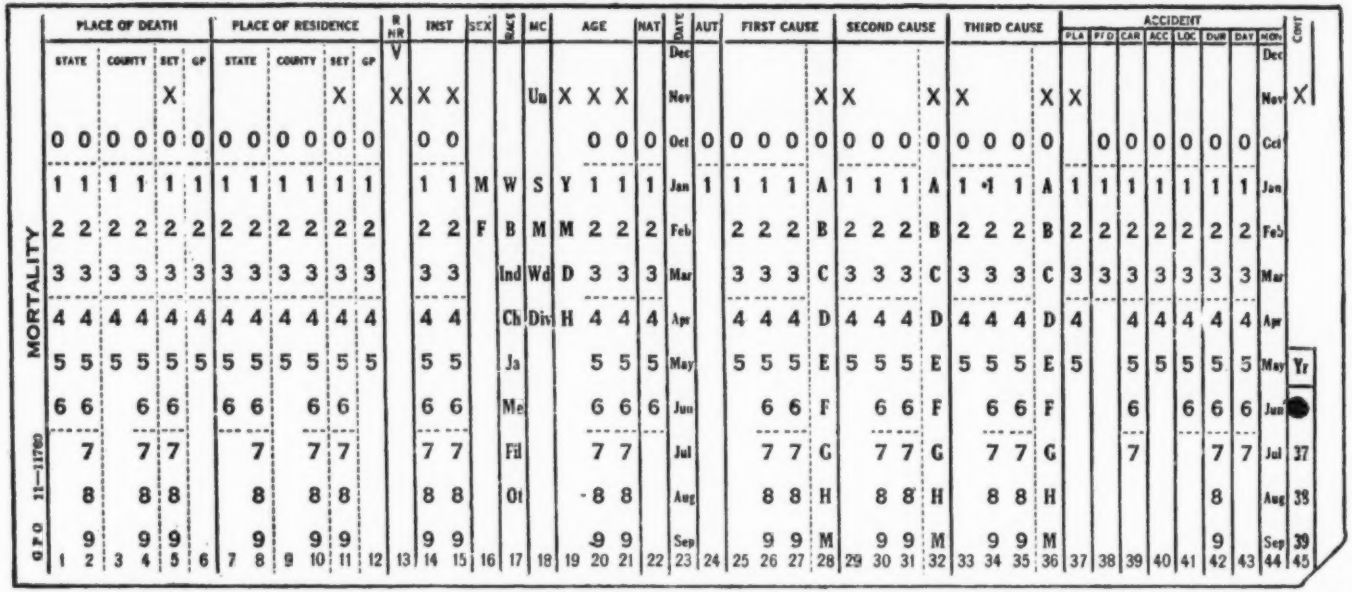
The tables given on pages 486 and 487, outlining the 1936 vital statistics tabulations, give three specifications for each tabulation: (a) the cards included; (b) the sorting groups; and (c) the classifications for which the counts are made.

In a sort of cards on the basis of two items, one sort is a sub-division or breakdown of the other. For example, if it is stated that the cards are sorted into "cause of death; sex," this means that the sex distinc-

[1] Truesdell, Leon E. "The Mechanics of the Tabulation of the Population Census," This JOURNAL, March 1935, Volume 30, pp. 89–94.

FIGURE 1

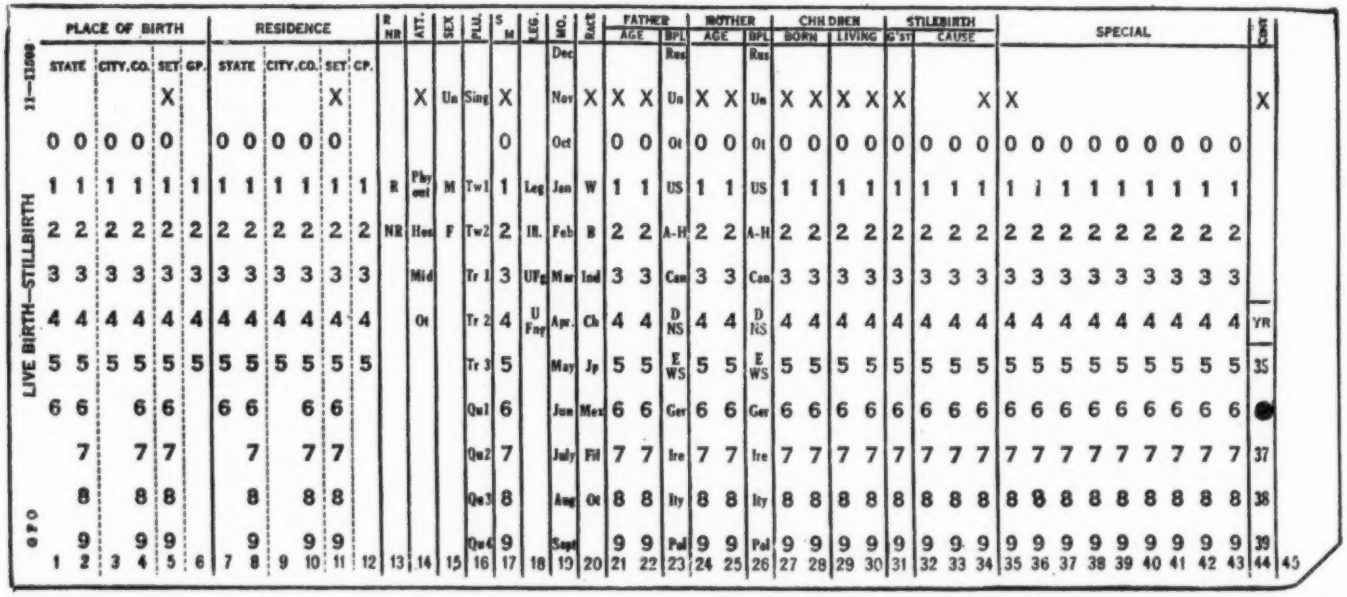
CENSUS MORTALITY CARD—1936



Information punched on mortality card: columns 1–6, place of death; columns 7–12, place of residence; column 13, resident or nonresident of place of death; column 14, type of hospital or institution in which death occurred; column 15, type of ownership of institution in which death occurred; column 16, sex; column 17, race; column 18, marital condition; columns 19–21, age (the code in column 19, years, months, days, hours, determines the meaning of the numerical code in columns 20, 21); column 22, brief code giving nativity of decedent and parents of decedent; column 23, month; column 24, autopsy, yes or no; columns 25–28, primary cause of death; columns 29–32, secondary cause of death; columns 33–36, tertiary cause of death (all cause of death codes according to detailed International List and selected by Joint Cause Manual); columns 38–44, additional data for motor vehicle accidents relating to place of accident, type of decedent (pedestrian or occupant), type of motor vehicle, nature of accident, location of accident, duration of injury, day of week on which accident occurred, month of accident; column 45, control for reproducing machine and year.

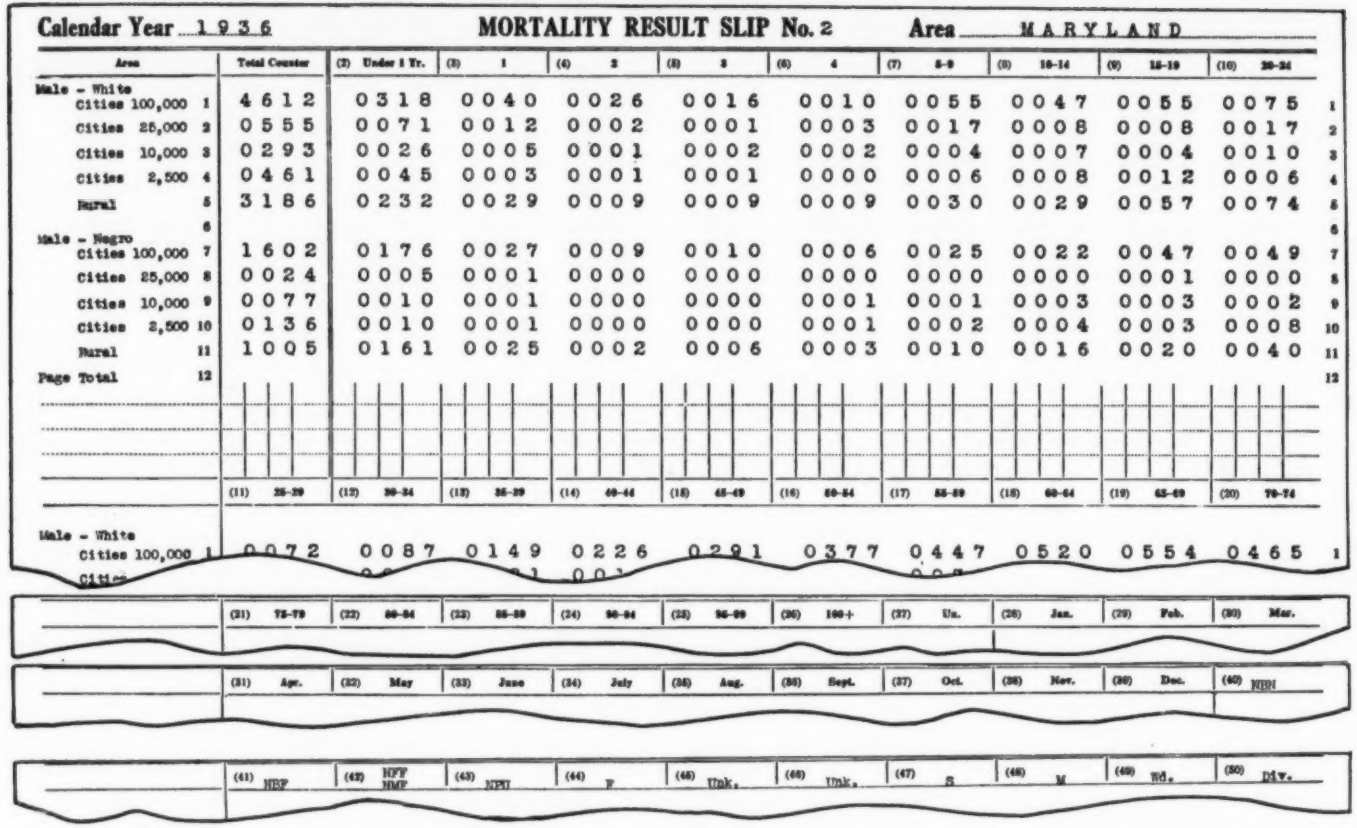
FIGURE 2

CENSUS NATALITY CARD—1936



Information punched on natality card: columns 1–6, place of birth; columns 7–12, place of mother's residence; column 13, mother, resident or nonresident of place of birth; column 14, attendant at birth; column 15, sex (unknown only if stillbirth); column 16, single or plural birth, number living if twins, triplets, etc.; column 17, sex of mates if plural birth; column 18, legitimacy; column 19, month; column 20, race; columns 21, 22, age of father; column 23, country of birth of father; columns 24, 25, age of mother; column 26, country of birth of mother; columns 27, 28, number of children born; columns 29, 30, number of children living; column 31, period of gestation for stillbirths; column 32–34, cause of stillbirth; columns 35–43, special field not used in 1936; column 44, control for reproducing machine and year.

FIGURE 3—CENSUS MACHINE SLIP FOR MORTALITY TABULATION NO. 2—1936



Calendar Year 1936 — **MORTALITY RESULT SLIP No. 2** — **Area MARYLAND**

Area	Total Counter	(2) Under 1 Yr.	(3) 1	(4) 2	(5) 3	(6) 4	(7) 5-9	(8) 10-14	(9) 15-19	(10) 20-24	
Male - White											
Cities 100,000	4612	0318	0040	0026	0016	0010	0055	0047	0055	0075	1
Cities 25,000	0555	0071	0012	0002	0001	0003	0017	0008	0008	0017	2
Cities 10,000	0293	0026	0005	0001	0002	0002	0004	0007	0004	0010	3
Cities 2,500	0461	0045	0003	0001	0001	0000	0006	0008	0012	0006	4
Rural	3186	0232	0029	0009	0009	0009	0030	0029	0057	0074	5
											6
Male - Negro											
Cities 100,000	1602	0176	0027	0009	0010	0006	0025	0022	0047	0049	7
Cities 25,000	0024	0005	0001	0000	0000	0000	0000	0000	0001	0000	8
Cities 10,000	0077	0010	0001	0000	0000	0001	0001	0003	0003	0002	9
Cities 2,500	0136	0010	0001	0000	0000	0001	0002	0004	0003	0008	10
Rural	1005	0161	0025	0002	0006	0003	0010	0016	0020	0040	11
Page Total											12

	(11) 25-29	(12) 30-34	(13) 35-39	(14) 40-44	(15) 45-49	(16) 50-54	(17) 55-59	(18) 60-64	(19) 65-69	(20) 70-74	
Male - White											
Cities 100,000	0072	0087	0149	0226	0291	0377	0447	0520	0554	0465	1
Cities											

	(31) 75-79	(22) 80-84	(23) 85-89	(24) 90-94	(25) 95-99	(26) 100+	(27) Un.	(28) Jan.	(29) Feb.	(30) Mar.

	(31) Apr.	(32) May	(33) June	(34) July	(35) Aug.	(36) Sept.	(37) Oct.	(38) Nov.	(39) Dec.	(40) NTIV

	(41) NRF	(42) NFF NMF	(43) NFNI	(44) F	(45) Unk.	(46) Unk.	(47) S	(48) M	(49) Wd.	(50) Div.

The reproduction shows the first "deck" with sorted groups indicated in the stub and counted items shown on the column heads. Column heads only are shown for the remaining decks since all stubs are identical.

tion is shown for each cause of death. But in the machine count, while each item is a breakdown of each item sorted, the items counted are usually parallel classifications and not successive breakdowns one of the other.

An example may serve to make this clear. Consider Mortality Tabulation No. 2. This tabulation is based on all mortality cards. These cards are first sorted into state groups. Each state group is sorted by sex; each state-sex group by race; and finally, each state-sex-race group is sorted on the basis of the population of the place of death. Then each of these state-sex-race-population groups is run through the unit counter, and counted by age, month of death, nativity, and marital status. The distribution by age is therefore available for each state-sex-race-population group, and so also is the distribution by month of death, by nativity, and by marital status. But the distribution by month of death is not available for age groups, nor is the distribution by nativity available for month-of-death groups.

Most tabulations involving geographic areas give the number of births or deaths according to the city or county in which the birth or death occurred. The exceptions to this are Mortality No. 12, in which the geographic areas are those of the place of residence of the decedent, and Natality No. 5, in which the geographic areas refer to the mother's residence.

Certain of the tabulations contain a classification based on the population of place of birth or death. This classification consists of the following groups: (a) rural part of counties, which includes everything outside of cities or incorporated places having more than 2,500 inhabitants; (b) cities or incorporated places of 2,500 to 10,000 population, designated as "rural cities"; (c) cities of 10,000 to 25,000; (d) cities of 25,000 to 100,000; (e) cities of 100,000 or more. This five-group classification is not used in all cases and, where the terms "Urban" and "Rural" are used alone, the "Rural" includes all areas under 10,000 population and the "Urban" all cities of 10,000 or more population.

Where the expression "detailed races" is used, the racial breakdown is in detail as punched in column 17 of the mortality card, except that positions 7 and 8 are thrown together. Where race is stated without qualification, the racial breakdown is White, Negro, and Other, or simply White and Other.

In addition to the tabulations outlined here, certain experimental tabulations will be made. Some of these will form the basis for more extensive and adequate state reports. Other rather extensive tabulations will be made, in order to obtain material for analysis of multiple

CENSUS MORTALITY TABULATIONS—1936

For each tabulation, items under "sorting specifications" are successive breakdowns, whereas items under "counting specifications" are breakdowns of each sorted group, but not successive breakdowns under each other. In all instances, the data tabulated are the number of deaths (exclusive of stillbirths) for each classification.

Tab.	*Cards included*	*Sorting specifications*	*Counting specifications*
1	Cards for cities of 10,000 or more population.	Each state; each city; sex; race for certain cities.	Five-year-age groups; month; detailed race; nativity of white.
2	All cards.	Each state; sex; detailed race; population of place of death.	Five-year-age groups; month; nativity; marital condition.
3	All cards.	Each state; detailed cause of death; sex.	Population of place of death by race; individual cities over 100,000 by race.
4	All cards.	Each state; race for selected states; detailed causes of death; sex.	Five-year-age groups; month; autopsy; secondary cause (yes or no); tertiary cause (yes or no); type of institution.
5	Cards for cities of 10,000 to 100,000 population.	Each state; race for selected states; selected causes of death; sex.	Each city.
6	Cards for areas under 10,000 population.	Each state; race for selected states; selected causes of death; sex.	Each county.
7	Cards for cities of 100,000 or more population.	Each state; each city; race for selected cities; selected causes of death; sex.	Five-year-age groups; month.
8	All cards for violent or accidental deaths.	Each state; type of accident; place of accident.	Five-year-age groups.
9	All cards for motor-vehicle accident deaths.	Each state; type of accident; rural; rural city; each city over 10,000 population.	Type of pedestrian, vehicle, accident; location of accident; duration of injury; day and month of injury.
10	All cards.	Each state; urban and rural groups; type of institution where death occurred.	Each city and county.
11	Cards for nonresident deaths.	Each state; urban and rural groups; type of institution where death occurred.	Each city and county.
12	Cards for nonresident deaths.	Each state of residence; urban and rural groups; type of institution where death occurred.	Place of residence; each city and county.
13	Cards for deaths under one year of age.	Each state; urban and rural groups; race.	Each city and county.
14	Cards for deaths under one year of age.	Each state; race; selected causes of death; detailed age groups; sex.	Population of place of death; individual city.
15	Cards for deaths under one year of age.	Total U. S.; cause of death; detailed age groups; sex.	Detailed race; month.
16	All cards except White or Mexican.	States of 1920, all others; Negro, other races; detailed causes of death; sex.	Five-year-age groups; month; detailed race.

CENSUS NATALITY TABULATIONS—1936

For each tabulation, items under "sorting specifications" are successive breakdowns, whereas items under "counting specifications" are breakdowns of each sorted group, but not successive breakdowns under each other. In all instances, the data tabulated are the number of live births for each classification.

Tab.	*Cards included*	*Sorting specifications*	*Counting specifications*
1	All cards.	Each state; rural, rural cities, each city over 10,000 population; sex.	Detailed race of child; parent nativity of White; month; nativity of father of White; nativity of mother of White; legitimacy by race.
2	All cards for plural births.	Each state; twin, triplet, etc., by number living; race; White by nativity of mother; age of mother in 5-year-age groups.	Age of father; number of children born; sex of mate; country of birth of mother.
3	All cards.	Each state; urban and rural groups; race; attendant at birth.	Each city and county.
4	Cards for nonresident births.	Each state; urban and rural groups; race; attendant at birth.	Each city and county.
5	Cards for nonresident births.	Each state of residence; race; attendant at birth.	Place of residence, each city and county.
6	All cards.	Each state; sex; race; country of birth of White mother; age of mother in 5-year-age groups.	Age of father; country of birth of father; number of children born; legitimacy by urban or rural.
7	All cards except those for Massachusetts and New Hampshire.	Race; country of birth of White mother; birth order of child; age of mother in 10-year-age groups.	Unit of age of mother; number of children living.

CENSUS STILLBIRTH TABULATIONS—1936

For each tabulation, items under "sorting specifications" are successive breakdowns, whereas items under "counting specifications" are breakdowns of each sorted group, but not successive breakdowns under each other. In all instances, the data tabulated are the number of stillbirths for each classification.

Tab.	*Cards included*	*Sorting specifications*	*Counting specifications*
1	All stillbirth cards.	Each state; rural, rural cities, cities of 10,000 to 100,000 as a group, each city of 100,000 or more population; sex.	Detailed race of child; parent nativity of White; month; nativity of father of White; nativity of mother of White; legitimacy by race.
2	All stillbirth cards.	Each state; urban, rural groups; race.	Each city and county.
3	Cards for plural stillbirths.	Each state; twins, triplets, quadruplets; race; age of mother in 5-year-age groups.	Age of father; number of children born; sex of mate; country of birth of White mother.
4	All stillbirth cards.	Total U. S. except Massachusetts (Massachusetts separately); sex; race; White by country of birth of mother; age of mother in 5-year-age groups.	Age of father; country of birth of father; number of children born; legitimacy by urban or rural.

causes of death. Specifications for these machine tabulations are not yet available.

The 1936 tabulations are designed to provide tables which are comparable in form with those published in recent years and to provide, in addition, new material relating to modern social and medical interests. A fundamental problem in any statistical agency, such as the Bureau of the Census, is to keep its classifications static enough to show time trends and, at the same time, to make such revisions as are needed. Needless to say, the nature and extent of mortality and natality tabulations have changed frequently since the Division of Vital Statistics was first established. The outlines given here are descriptive only of the 1936 tabulations. Future revisions are contemplated, which will omit certain data of little social or medical importance, and add more valuable information.

ON AN ATTEMPT TO REDUCE INFANT MORTALITY IN DENMARK

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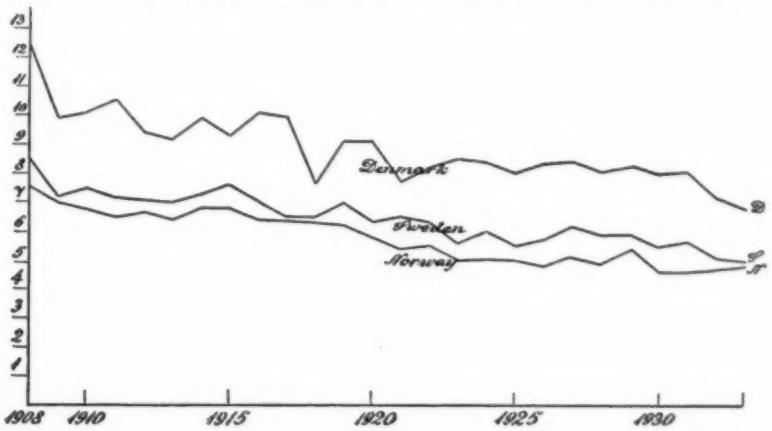
I

Of the Scandinavian countries, Norway, Sweden and Denmark, the last-mentioned holds a rather bad record as far as infant mortality is concerned, and this has been the case for many years, even after statistics began to show a declining movement in all the three countries.

In order to obtain a survey of the respective levels in the three countries we may construct an index of the variations from year to year by computing in the ordinary and well-known way the ratio between the number of deaths occurring during a calendar-year among

FIGURE 1
INFANT MORTALITY IN THE SCANDINAVIAN COUNTRIES 1908–1933



babies having not yet passed their first year and the number of children born alive during the same year. Of course this method cannot be entirely exact, because in actual fact the number of deaths does not wholly originate from the number of births of the same year, but partly from births during the preceding year. However, merely for the purpose of obtaining a survey the present method should suffice.

In the diagram (Figure 1) the upward and downward movement of infant mortality during the greater part of the present century has been illustrated for each of the three countries. As will be seen the

mortality has fluctuated rather considerably; but in spite of these irregularities the movements must be interpreted mainly as declining. Further, the courses of the three curves show marked parallelism, which undoubtedly puts Denmark in a rather unfortunate position, not particularly because the Danish curve is the upper one, but mainly because this curve invariably runs at a remarkably higher level than the other two curves.

For the last 10 years alone we quote the following indices (percentages):

	Norway	Sweden	Denmark
1924	5.0	6.0	8.4
1925	5.0	5.5	8.0
1926	4.8	5.6	8.4
1927	5.1	6.0	8.3
1928	4.9	5.9	8.1
1929	5.4	5.9	8.3
1930	4.6	5.5	8.0
1931	4.6	5.7	8.1
1932	4.7	5.1	7.2
1933	4.8	5.0	6.8

On an average the infant mortality of Norway and Sweden was 5.3 per cent during these years, while the corresponding figure for Denmark was 8.0 per cent. This means that the infant mortality of Norway and Sweden is only two-thirds of that of Denmark, and it should be noted, that even if we took the numbers of still-born children into account, the result would not differ.

A good deal of time has been spent in studying the causes of this phenomenon, which has puzzled medical as well as statistical science.[1] Several physicians have conducted propaganda campaigns to institute measures against certain supposed causes.

The Health Committee of The League of Nations has devoted its attention to the problem and it has been dealt with at an official nordic statistical conference, etc. No wonder that the National Health Service of Denmark in 1929 most willingly accepted a generous offer from the Rockefeller Foundation of a financial contribution towards a practical attempt at reducing the high infant mortality of the country on condition that the Danish authorities would undertake to follow the matter up if the attempt should appear to be successful.

In order to carry out this experiment three districts were selected, one of which for special reasons was chosen within the capital of

[1] Cf. H. Cl. Nybølle: "Infant mortality in the northern countries," *Nordic Statistical Journal*, vol. 3, Stockholm 1931, p. 311. Read before the official conference (Helsingfors 1931) of the chiefs of the state statistical bureaus of the nordic countries.

Copenhagen; the two others, on the other hand, were chosen in the rural districts, one of them in the insular part of the country, the other in Jutland (the Holbæk and Vejle districts respectively). Then three excellently trained nurses—one for each district—were charged with the task of approaching all mothers who in each of the districts had recently given birth to children, immediately offering them gratuitously all their experience of child-nursing; and moreover, during the first year of each child, regular periodical visits in order to advise and help the mother also gratuitously. By special agreement the nurses received communications from the official birth-registers about births occurring in their districts.

For each child under nurse-control the nurse had to keep a diary gradually supplied with facts which might be of interest for a judgment of the hygienic and social conditions of the "life" under consideration. These diaries contain a large number of records well worth a closer study. Here we only make use of those that concern the computation of the mortality (cf. below).

II

What would be the effect of these measures could not possibly be ascertained if other measures were not taken with the object of showing the mortality among a group of children under essentially identical conditions, but not influenced by the efforts of the nurses. For this purpose there was, of course, the current records of the official statistics. For several reasons, however, the utilization of this possibility was found less apposite in this connection. The registrations of births and deaths take place in the districts where these actually occur and, even in cases of the decease of babies, independently of each other. This drawback does not matter when experiences from the country as a whole are utilized for computing infant mortality; for then it is only migrations between Denmark and other countries which may disturb the calculations, and these migrations may ordinarily be considered trifling so far as babies are concerned. If on the other hand we purposely confined ourselves studying the mortality within a limited home-district, for instance so limited that the conditions must closely resemble those of the nurse-districts, we could not ignore migrations to and from the district (cf. below).

In order to procure more reliable observations special measures therefore must be taken. The possibilities for such, however, existed. For besides the legal registrations of births and deaths (ordinarily undertaken by the clergy) Denmark has a coordinated registration of the population settled in each local district, undertaken by the local

authorities. In addition to births and deaths the population-registers record the movements of the inhabitants. Now, suitable districts (in the following called "control-districts") in the neighbourhood of the nurse-districts were chosen and, as far as the rural districts are concerned, the Danish State Statistical Department was charged with collecting records from the said population-registers of the control-districts, records suitable for a more exact ascertainment of the infant mortality of the control-districts. For each child reported to the register as being born alive in the district, but not for children reported as to have immigrated into the district, the Department, according to an arrangement made for this purpose, received a special report; if the child in question died or moved away from the district before having reached exactly the age of one year the report was given when the child departed; if the child reached its first birthday while living in the district the report was given when this fact had been stated.

The reports were in other respects the plainest possible. They only stated the name, profession, and place of residence of the parents, the day and year of the mother's and the child's birth, the sex and legitimacy of the child, and finally, either the time at which the child had departed (died or moved away) or, in the opposite case, a direct notice of the anniversary. If any changes reported to the register had occurred as to the conditions of the child (if the parents married or the child was put out to nurse, etc.) such incidents were noticed too.

According to the scheme the activity of the nurses was to begin on April 1, 1929 and was to comprise the children born alive in their districts during the ensuing five years. Pursuant to this scheme the transmission of the reports from the population-registers of the "control-districts" began at the same date and was likewise to comprise all children born alive in these districts during the ensuing five years. Consequently, the whole enterprise could not be brought to an end until a year after the last child under observation had been born, which meant the first of April 1935. Afterwards the material has been reviewed and coordinated.

One of the tasks has been to ascertain whether a "nurse-effect" on the infant mortality could be discovered. I have been able to perform this investigation only for the rural districts, because I had only—on behalf of the Statistical Department—to deal with these districts. Moreover, a corresponding statistical review of the observations originating from the district of Copenhagen has for several reasons not been possible.

Without regard to this latter circumstance it may be of some interest to consider briefly how the existing rather few but first class observations might be utilized in order to get as much use of them as possible. It would, at any rate, be a pity to dispatch them with only a few vapid remarks.

III

In order to elucidate the sizes of the sets of rural districts under comparison we state the extent of the districts and, according to the Danish census of 1930, the numbers of inhabitants.

	Nurse-districts		*Control-districts*	
	Area square miles	Inhabitants	Area square miles	Inhabitants
Insular districts	61	7,950	162	23,000
Jutland	157	12,200	148	22,100
Total	218	20,150	310	45,100

In spite of the rural character of the districts it may easily happen that there are urbanized agglomerations within the districts presenting hygienic and social conditions which may differ slightly from the other part of the same district. In this respect the selection of the districts, however, must be considered rather fortunate. We quote the number of inhabitants of urban agglomerations within the districts; the areas, on the contrary, are not recorded in Danish statistics.

	N-districts	C-districts
Insular district	—	2,235
Jutland	1,904	3,751
Total	1,904	5,986

Thus the population of the agglomerations constitutes a rather negligible part of the entire population of the districts.

As will be seen the extent of the C-districts was about twice that of the N-districts. Whether districts of these sizes might be supposed to be sufficiently large for a final conclusion to be drawn concerning the significance of the difference between the mortality of each of the districts must necessarily depend upon the actual difference finally arrived at; and, of course, this could not possibly be stated from the very beginning. The extent of each of the N-districts was limited beforehand, however, by the amount of work a single nurse would be

able to do; consequently no reason was found for enlarging the C-districts beyond several times the size of the corresponding N-district.

During the five years ending March 1934, the number of children born alive in the districts were the following;

	N-districts	C-districts
Insular district	745	2,022
Jutland	1,451	2,013
Total	2,196	4,035
Viz:		
Boys	1,131	2,087
Girls	1,065	1,948
Legitimate	2,087	3,769
Illegitimate	109	266

Now, it was an important part of the activity of the nurses to succeed in obtaining entrance to the homes. If only a certain small proportion of the children in the nurse-districts were superintended it might be feared that this proportion would represent those living under particularly bad hygienic and social conditions, who to be sure were more in need than the remainder of the nurse-assistance offered, but who would at the same time tend to give us an impression of the mortality which is below the actual level. Thus, the ability of the nurses did not especially depend on their professional skilfulness but a certain amount of policy and discretion were also required.

In this purely human respect the nurses appear to have been extremely successful, at any rate they managed to get into touch with most of the mothers, cf. the figures below.

Nurse-districts	Number of births	Nurse-controlled children	
		total numbers	per cent of births
Insular district	745	707	94.9
Jutland	1,451	1,382	95.2
Total	2,196	2,089	95.1
Viz:			
Boys	1,131	1,075	95.0
Girls	1,065	1,014	95.2
Legitimate	2,087	1,997	95.7
Illegitimate	109	92	84.4

The following remarks apply to the mortality of these 2,089 nurse-controlled children as compared with the mortality of the aforesaid

4,035 control-children. Amongst the two groups of children 57 and 256, i.e. 2.73 and 6.34 per cent respectively died before entering upon the second year of their life, apparently a considerably lower mortality of the "nursed" children than that of the "non-nursed."

The validity of the immediate statement is completely broken down, however, by two main objections. Firstly, it must be observed that the group of nurse-children comes into existence in quite a different manner from that of the control-children. These latter from the very beginning of their lives made their entrance into the group of this kind of children without any formality. As to the children of the nurse-districts, on the contrary, a certain time had necessarily to elapse, in the first place before the nurse received the information from the birth-register that a child had been born, and in the second place before the nurse on her side could pay her first visit or—if necessary—could persuade the mother to have the child enrolled in the group of nurse-children. Even if the nurse exerted herself to put the negotiations through as quickly as possible, she would also have to wait and see and not be too pushing. Thus the cases in which the child died before the nurse arrived or succeeded in her object must cause entrances into the group of nurse-children exclusively to take place gradually and never immediately at the birth as was the case in the control districts; these different conditions if they remained unconsidered would contribute to diminish artificially the immediate expression of the mortality of the nurse-districts for, as everyone knows, the rate of infant mortality is especially high during the first days or weeks of life.

Secondly, as to the events which decrease the groups, it must further be realized that removals from the districts influence the actual number of deceases as well as the momentary size of the groups, and at the same time the immediate expression of mortality, especially if the removals have a different age-distribution in the two districts.

Consequently, we must consider how the increasing and decreasing occurrences are distributed over the interval from birth to the first anniversary. In performing this task no reason was found for investigating the occurrence of the fluctuations in mortality, which possibly took place during the 6 years of observations. We therefore operate as if all the children under consideration were born at the same moment and were living and departing exactly as contemporaries.

Nor do we pay any attention to the manner in which the size of the two groups has really varied from time to time. On an average they have comprised 390 and 715 children respectively, as seen from the number calculated below; but in fact each of the two groups increased

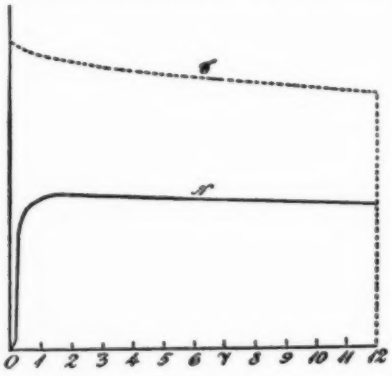
gradually from April 1929 till April 1930, mainly due to new births; then a certain equilibrium appeared, produced, on one hand, by the successive abandonment of one-year-old children, beginning at April 1930, and on the other hand by the steady entrance of new-born children, which two causes nearly compensated each other. This balance continued till April 1934, when no more new-born children were accepted so that the groups gradually decreased during the last year of the investigation, ending April 1935.

IV

How the size of each of the two fictitious groups has altered as functions of age is described in Table I in which the various kinds of events (deaths, immigrations and emigrations) are distributed over the age-intervals quoted. Further the sizes of the groups are added for each of the points of time which separate the intervals employed. In the diagram (Figure 2) the courses of the two functions (N and C)

FIGURE 2

AGE-DISTRIBUTION OF THE NURSE-GROUP (N) AND THE CONTROL-GROUP (C)



are pictured. As will be seen the group of the control-districts is at full height from the very beginning because no one is introduced later on. For this reason the course of this group is decreasing monotonic.

As to the group of the nurse-districts, on the contrary, it will be seen that the entrances are to some extent scattered over the entire age-interval of one year; even if the greater part (about 75 per cent) of these entrances take place within a week after birth (i.e. three-fourths of all the "nursed" children have been entered into the nursing scheme before they reached the age of one week) this group does not exist from the very beginning and does not reach its maximum size until the age of about two months has been passed.

TABLE I

COMPARISON OF TWO GROUPS

Ages and age intervals (months)	Nurse-districts				Control-districts			
	Entrances	Secessions by decease	Secessions by removal	Resulting group	Entrances	Secessions by decease	Secessions by removal	Resulting group
0	1572	0	0	0	4035	0	89	18	4035
½	279	1	2	1572	0	16	13	3928
1	151	1	14	1848	0	14	33	3899
2	45	10	21	1984	0	25	64	3852
3	23	8	16	1998	0	25	53	3763
6	14	14	34	1997	0	49	99	3685
12	5	23	44	1963	0	38	155	3537
				1901				3344
Total	2089	57	131	—	4035	256	435	—
Viz.								
Boys	1075	33	52	—	2087	148	208	—
Girls	1014	24	79	—	1948	108	227	—
Legitimate	1997	56	98	—	3769	232	344	—
Illegitimate	92	1	33	—	266	24	91	—

On an average of the equilibrium-episode the two curves of Figure 2 also describe the age-distribution of the groups at every moment; computing the areas indicated by the curves we find that the total sum of months in which the children have been living under observation amounts to 23,102 months for the N-districts and 42,919 months for the C-districts. If we divide these amounts by sixty months we find the average-size of each group (390 and 715 respectively) as mentioned above.

From this we can make an estimate of the daily work of the nurses. If for this purpose we assume that x visits a year would suffice for each superintended child and that each of the nurses was able to pay y visits per working day then, putting the year at 300 working-days we obtain $600y = 390x$, which means $y = 0.65x$, giving the following tabulation:

Number of visits per child	Average number of visits per working day
x	y
4	2.6
6	3.9
8	5.2
10	6.5
12	7.8

Thus the nurse-districts could not possibly have been essentially larger. The only manner in which an extension of the field of experience might have been obtained would consequently have been by increasing the number of districts; but this measure would have required more nurses.

If we divide the total sum of months by the total number of children entered in the two groups (2,089 and 4,035 respectively) we find 11.06 months for the N-districts and 10.64 months for the C-districts, which figures express the time each child on an average has been under observation. Even if the children of the nurse-districts have been entered at a higher age (on an average at 8 days old) than the children of the control-districts, the former appear to have been under observation during a longer time than the latter. By a cursory estimation of the figures of the table it will be seen, however, that the children of the nurse-districts have not emigrated by removal to a similar extent as the children of the control-districts, for the number of removals from the N-districts does not in any age-interval amount to nearly half the number of removals from the C-districts as might be expected under equal conditions. Nor do the nurse-children appear to have died to a similar extent as the control-children; for a similar lack of proportionality seems to rule also the number of deceases. This latter circumstance is, however, of decisive importance and requires a closer study.

V

In order to carry through the proposed investigation, several ways might be taken. Without discussing such possibilities we prefer to utilize the observations as they lie before us in the aforementioned table; and since the existence of deaths as well as of migrations as simultaneously altering causes constitutes the problem of grasping from this muddle the effect of the mortality, we propose in this connection to compute those probabilities for surviving a given age-interval which *J. Karup*[2] has termed independent probabilities, for which probabilities, p, we have the following formula applying to a not too large interval;

$$-\log p = \frac{D}{S_0 - S_1} \log \frac{S_1}{S_0}.$$

[2] For instance in the "Finanzlage der Gothaischen Staatsdiener-Witwen-Societät"; but the considerations, underlying the theory of independent probabilities, may be found elaborated and critically described for instance by P. Spangenberg: "Die Karupsche Theorie der unabhängigen Wahrscheinlichkeiten," (*Veröffentlichungen des deutschen Vereins für Versicherungswissenschaft*, Heft XX, Berlin 1911, p. 91), or by P. E. Böhmer: "Theorie der unabhängigen Wahrscheinlichkeiten," (*Septième Congrès international d'Actuaries*, vol II, Amsterdam 1912, p. 327).

In this formula D denotes the number of deceases occurring during the interval and S_0 and S_1 the size of the group at the beginning and at the end of the same interval. It should be observed that an elementary transformation shows that we simply must have

$$-\log p = D/S_0$$

if it happens that $S_0 = S_1$.

If we apply this formula to each of the intervals indicated in the table, we find the following values for $-\log p$ where the symbol $\log p$ denotes natural (Napierian) logarithms

Interval (months)	Values of $-\log p$	
	N-districts	C-districts
0– ¼	—	0.02236
¼– ½	0.00058	0.00410
½– 1	0.00053	0.00362
1– 2	0.00504	0.00656
2– 3	0.00405	0.00670
3– 6	0.00707	0.01356
6–12	0.01190	0.01105

As to the N-districts no value for $-\log p$ has been computed for the interval 0–¼; this lack is merely a statement of the fact that proper observations actually fail in this instance, simply because the group, when merely in the phase of creation, cannot possibly at the same time yield mortality-experiences. Much the same also applies to the following two intervals, though to a slighter extent. Upon the whole the statement of the mortality of the N-districts for these early intervals cannot be considered as particularly clear.

The values of $-\log p$ are given by means of natural logarithms; this may be useful if we want to consider the probability, q, of dying before exceeding a given interval instead of the probability, p, of surviving it; for then at any rate we have

$$-\log p = -\log(1-q) = q + \tfrac{1}{2}q^2 + \tfrac{1}{3}q^3 + \cdots$$

and using the smaller intervals we should be completely satisfied by the first term only of this series, putting simply

$$q = -\log p,$$

the values of which probabilities then immediately appear from the tabulation above of $-\log p$.

Further, if we accumulate the values of $-\log p$ we find the ordinary biometric function $-\log l_x$, l_x denoting the number of survivors, the derivative of which function

$$-\frac{1}{l_x}\frac{\delta l_x}{\delta x}=\mu_x$$

will furnish us with the intensity of mortality, the biometric function which most obviously describes how mortality varies as a function of age.

In the same way we obtain the following tabulation of $-\log l_x$:

x (months)	N-districts	C-districts
0	—	−0.02236
¼	0.00000	0.00000
⅓	0.00058	0.00410
1	0.00111	0.00772
2	0.00615	0.01428
3	0.01020	0.02098
6	0.01727	0.03454
12	0.02917	0.04559

In this table we have arbitrarily put $-\log l_x=0$ for $x=\frac{1}{4}$ month and thus we have started the accumulation from this origin.

This means again that the corresponding values of l_x do not start for $x=0$ at identical radices, a fact, which is of no importance, however, in view of the computation of the force of mortality.

In order to compare on one hand the mortality of the two districts and on the other hand the conditions of these districts with those of Denmark as a whole we have also computed the corresponding values of $-\log l_x$ from the data of the official statistics concerning the infant mortality of the whole country; these data, however, treat the interval from $x=\frac{1}{4}$ to $x=1$ under one heading only; starting as above, the accumulation at $x=\frac{1}{4}$ we obtain for the whole of Denmark the following values:

x (months)	$-\log l_x$	x (months)	$-\log l_x$
0	−0.02245	3	0.02296
¼	0.00000	6	0.03836
1	0.00822	12	0.05464
2	0.01536		

Now, in order to illustrate the different manner in which $\log l_x$ for each of the three systems (in the following denoted N, C, and D, respectively) ascends with increasing age we have plotted the stated values of $-\log l_x$ in the annexed diagram (Figure 3) and further connected successive points of each system by straight lines.

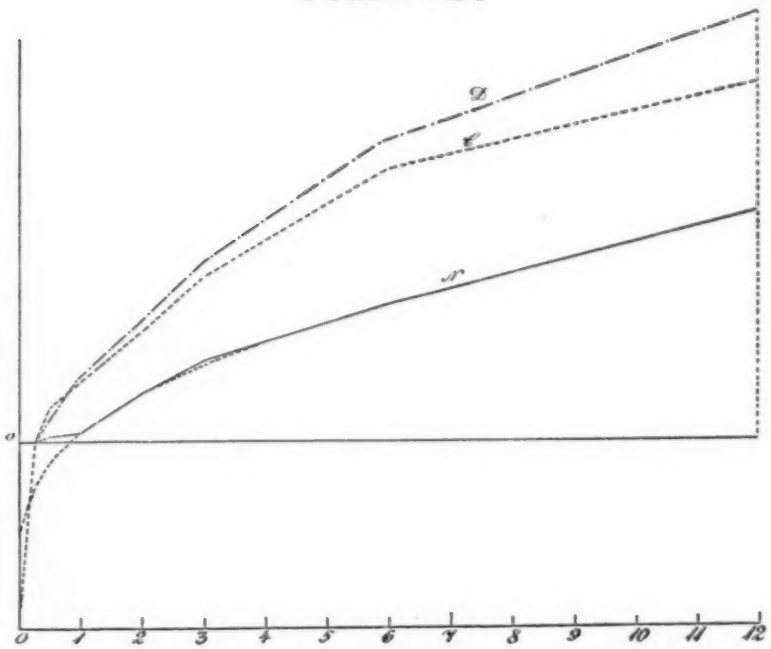
By these polygons we should be enabled to distinguish the three

systems of points more easily. It must be a matter of course that $-\log l_x$ cannot be supposed to vary minutely according to these lines; they have been drawn only in order to facilitate the distinction.

The different manner in which the three sets of points actually ascend with increasing age affords an excellent illustration of how the mortality in the three groups under consideration varies within ages from $\frac{1}{4}$ to 12 months; we see immediately that the D-polygon ascends more rapidly than the C-curve and this curve again more rapidly than the N-curve.

FIGURE 3

COURSE OF $-\log l_x$



In this survey the latter curve moreover appears to ascend particularly slowly over the intervals from $x=\frac{1}{4}$ towards $x=1$. But whether this peculiarity originates from the natural circumstance that the nurses had nothing to do where the child was dying or had just died on their arrival—a well-known phenomenon of selection in several other connections—or whether the slow ascent is due to the lack of sufficient observations, does not call for any attention in this connection. However, one can, on the whole, scarcely escape the obvious impression that the mortality of the N-districts is at a lower rate than the mortality of the C-districts, though the latter, compared with the infant mortality of the whole country must be considered rather low.

Those who possess a closer knowledge of the hygienic and social conditions of the various localities of the country can have no doubt that the chosen control-districts as to mortality in general, belong to the better part of the country, a circumstance which, of course, is worth noticing in the present connection.

VI

We have attached these remarks to the diagram in Figure 3 and the values of $-\log l_x$ instead of attaching them to a description of the derivative function of $-\log l_x$, i.e. the intensity of mortality. For since the computation of this latter function

$$\mu_x = -\frac{\delta \log l_x}{\delta x}$$

requires some sort of differential gear, it cannot be performed without a preceding adjustment of the stated values of $-\log l_x$, requiring in its turn certain assumptions, which in fact may be considered superfluous for the topic before us.

If, however, we want to study more closely how the intensity of mortality of the three groups may after all be supposed to run, there is nothing to prevent us, of course, from trying to make the adjustments necessary. Even if the mortality of the three groups on an average must be supposed to range the groups as recently described, it is still left for further consideration to investigate to what extent the average differences may be recognized over the entire interval from, say one month to one year; for when comparing the mortality of various groups—especially in the treatment of infant mortality—we have to realize that the mortality of each group must be substantiated by a certain function of age, not by a single numerical term.

Here again, in order to perform the desired adjustment various roads may be taken. A method which appears to involve a smaller amount of arbitrary assumptions than any other is probably the one I have proposed to call pseudo-analytical graduation.[3]

Though this procedure should be particularly applicable for our present purposes, we propose, however, to take up a more conventional line, choosing a proper analytical function, the constants of which may be found by a regular adjustment according to the method of least squares. The reason why we do so is the plain one that particularly for application in the case of infant mortality we possess a

[3] Cf. H. Cl. Nybølle; "On pseudo-analytical graduation," *Journal of the Institute of Actuaries*, vol. LXVI. Part I. No. 314, London 1935.

most convenient expression, analytical and linear with respect to its constants, originating from Professor Oppermann (1817–1883) the Danish actuary, who is but too little known. Oppermann's formula[4] runs as follows

$$-\log l_x = a + b\sqrt{x} + cx + dx\sqrt{x}$$

or, if we want to express directly the intensity of mortality,

$$\mu_x = \tfrac{1}{2}b/\sqrt{x} + c + \tfrac{3}{2}d\sqrt{x}$$

As to the range of ages over which this formula may be considered to apply, there is no reason for discussing this question here. Referring to the papers quoted above, it will suffice to emphasize that a close fit must be expected when we treat only the limited interval 0–1 year.

Now, the adjustment can be performed in a straight-forward manner; from the formula

$$-\log l_x = a + b\sqrt{x} + cx + dx\sqrt{x}$$

we deduce the following one

$$-\log (l_y - l_x) = -\log p_x$$
$$= b(\sqrt{y} - \sqrt{x}) + c(y - x) + d(y\sqrt{y} - x\sqrt{x})$$

and putting here gradually for x and y the values limiting the intervals, used above in the tabulations of $-\log p$, we obtain the observation—equations; from these equations again we have to form the ordinary normal-equations, the solution of which will furnish us with the values of the constants b, c and d.

In the formation of the normal-equations concerning the C- and D-systems of Figure 3 we have assumed that all the observation-equations have equal weight; for the groups from which the values of the $-\log p$ of these two systems have been calculated are monotonic decreasing and the decrements of the considered interval (0–1 year) amount to such relatively restricted values that a real effect in this connection could scarcely be expected even if they were properly considered.

As to the adjustment of the N-system, the matter is quite different. Here the various values of $-\log p$ must be estimated as being of un-

[4] Cf. The Insurance Record (Institute of Actuaries) 1870, February 11th. See also: J. F. Steffensen: "Infantile mortality from an actuarial point of view," *Skandinavisk Aktuarietidsskrift*, vol. XIII, Uppsala 1930, p. 272.

equal accuracy even to the extent that the adjustment of the N-polygon of Figure 3 ought to be performed only from the data concerning the interval of say $x=1$ to $x=12$. On the other hand, we have counted all the observed values of $-\log p$ within this interval as being of equal accuracy.

By these adjustments we have found the following values for the constants of the formula $b\sqrt{x}+cx+dx\sqrt{x}$

	b	c	d
N	0.01774	−0.00326	0.00049
C	0.04453	−0.01132	0.00129
D	0.04014	−0.00894	0.00112

Analytically these values describe very nicely the course of the polygons N, C and D in Figure 3; to the N-diagram we have added, by a dotted line, the course for x-values smaller than those directly used for the adjustment; in the remainder of the interval the N-polygon and its adjustment are scarcely distinguishable if we try to picture both of them in the diagram.

From the adjusted values of $-\log l_x$ we may express by means of a single term the mortality of each group, considering the difference $\log l_y - \log l_x = \log p_x$, and from this difference again we may compute either the probability, p, for surviving the interval from x to y or its complementary amount, $q=1-p$. Confining ourselves—on account of the lack of sufficient observations from the earliest ages in the N-districts—to the interval from say 1 month to 12 months, we find the following values for the probability that a child, having passed the age of one month, will die before reaching the age of 12 months, the observed probabilities being compared with the adjusted ones.

	Observed	Adjusted
N-system	0.02767	0.02736
C-system	0.03716	0.03691
D-system	0.04543	0.04497

Thus the agreement between the two sets of values must be considered rather fine.

Now we can also compute the course of the force of mortality for each system according to the formula

$$\mu_x = \tfrac{1}{2}b/\sqrt{x} + c + \tfrac{3}{2}d\sqrt{x}$$

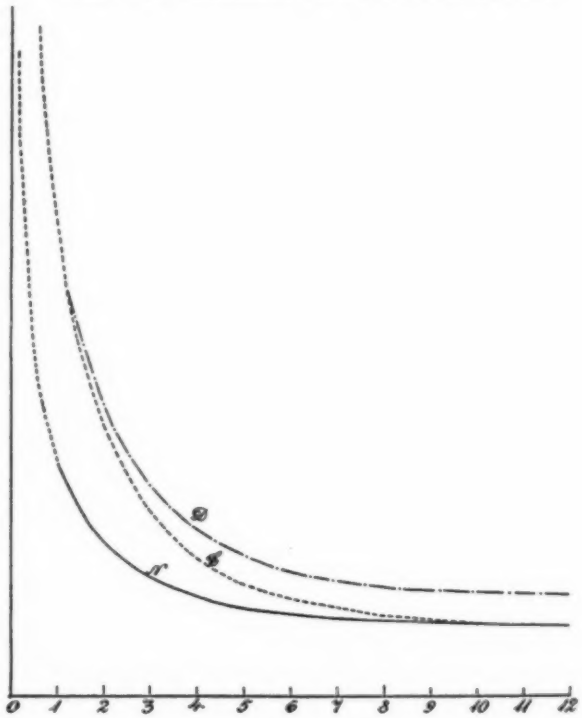
and we then find the following table where the μ-values, however, have been multiplied by 12 in order to express them in the conventional way, using one year as unit.

Age (months)	Force of mortality N	C	D
1	0.076	0.155	0.155
2	0.049	0.086	0.092
3	0.038	0.059	0.067
6	0.026	0.030	0.040
9	0.023	0.023	0.033
12	0.022	0.022	0.032

From these figures as well as from the survey given in Figure 4, where the course of μ_x for each of the three systems has been pic-

FIGURE 4

FORCE OF MORTALITY AS A FUNCTION OF AGE



tured, we see how the mortality of the C-system runs between the N- and D-systems; at the beginning of the interval no difference between the C- and D-systems is noticeable, on the other hand, towards the end of the interval no difference is found between the C- and N-systems. Whether this peculiarity suggests something concerning the N-districts or something concerning the C-districts or—as a third pos-

sibility—something concerning both of them, may finally be a matter of opinion. *At any rate, we can scarcely make a more perspicacious image of the effect on infant mortality of the present nurse experiment.*

If from the course of μ_x we want to find how much infant mortality may be supposed to have been diminished by the nursing scheme we may compare the values of

$$\int_1^{12} \mu_x \, dx = \log l_1 - \log l_{12};$$

for each of the three systems considered in which case we find the following values for this integral:

	Observed	Adjusted
N	0.02806	0.02773
C	0.03787	0.03761
D	0.04642	0.04601

Thus, on an average, the mortality of the N-districts amounts to only 74 per cent of the mortality of the C-districts though the mortality of the latter does not amount to more than about 80 per cent of the mortality for Denmark as a whole. As far as can be seen the nurses, consequently, appear to have succeeded in reducing the mortality to a level similar to that found in the other Scandinavian countries.

VII

Even if these results may be suggestive of a happy effect of the interesting nurse-experiment, it must, however, be realized that the number of observations at our disposal have been rather limited. It may also be questioned, to what extent the size of the material, in a strictly statistical sense, may warrant this suggestion.

To deal with this question, too, it would be a straight-forward method to turn to the figures by which we have tried to express the mortality in a single term, for instance the probabilities of dying which we have considered above. But trying also to compute immediately the standard deviations, we are faced with the question: "How many observations have been spent on the numerical estimation of them?" and here the extent of the material is not given immediately by the size of the group quoted in the table, these groups having been influenced not only by deceases but also by migrations.

Consequently, we had better consider again each of the intervals used, and for each of these we prefer to consider the probability, q, of dying before exceeding it, for which probability we simply have

$$q = -\log p$$

as stated above.

As to the number of observations which may reasonably be estimated as having been spent on the computation of these probabilities we have to take advantage of the application of smaller intervals; for, adding to the average size of the group of a given interval something like half the number of the deceases during the interval, we must arrive at a usable expression for the number of children exposed to risk, assuming that the group has diminished only by desease.

We are now enabled to obtain the standard deviations of the probabilities, q; further, we are enabled to unite the results from some or all of the intervals if we compute the expected numbers of deaths as well as the standard deviations of the latter, adopting for this computation a population of children of a certain arbitrary but fixed age-distribution chosen anyhow, but successively submitted to the mortality of the N- and C-districts quoted above. For this purpose we have chosen an age-distribution fairly similar to that of the two districts, viz:

Exact ages (months)	Exposed to risk
¼	161
½	169
1	172
2	170
3	167
6	161

Considering first the whole interval from, say, ¼ month to 12 months we obtain, by well-known algorithms,[5] the following result:

	Expected deaths	Standard deviation
N-districts	4.83	0.64
C-districts	7.58	0.58
Difference	2.75	0.86

Since the difference amounts to more than three times the standard deviation, the lower mortality of the N-districts can scarcely be assumed to be exclusively due to purely accidental circumstances; but this very fact does not entitle us to think that consequently the difference must be exclusively due to the nurse-effect; several other causes may have contributed, for instance the unquestionable phenomenon of selection, mentioned above, which appears almost in-

[5] H. Westergaard: "Scope and method of statistics," chapter IX. *Quarterly Publications of the American Statistical Association*, XV (1916), p. 225; elaborated in the text-book (by Westergaard and the present author): *Grundzüge der Theorie der Statistik*. Jena 1928, §344.

variably when we have to define ideally a certain group of persons usable for the measurement of mortality, and have afterwards to make the distinction between the persons belonging to the group and those who do not.

If for this reason we confine ourselves to the interval from one month to twelve months we find by a corresponding estimation:

	Expected deaths	Standard deviation
N-districts	4.65	0.62
C-districts	6.31	0.49
Difference	1.66	0.79

Now the difference does not amount to more than 2.1 times the standard deviation; and thus the number of observations appears to be rather limited in order to satisfy those who might doubt that statistical methods should be able to prove the relevance of a practical measure; for several reasons it would, however, scarcely be possible to imagine the existence of anyone who might doubt the possibility of lowering infant mortality at all by better nursing; but this is quite another story.

STATISTICAL AND ECONOMIC PROBLEMS IN THE ADMINISTRATION OF SOCIAL SECURITY*

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There can be no clear understanding of the statistical and economic problems confronting social scientists in this newly-developed field of social security until there is some appreciation of the administrative complexities which it presents. Therefore, as an introduction to the subject of this paper a brief review of the administrative background of the Social Security Act is necessary.

To begin with, the social security program is a combination of federal and state-federal administration. The old-age benefits administration is on a strictly federal basis, while public assistance and unemployment compensation are both administered by the states with a certain amount of federal supervision.

Furthermore, there exists in the different parts of the program a varying amount of decentralization. Any program which is administered on a state basis is, from a federal standpoint, somewhat decentralized, but of course there may be further decentralization within the state itself down to the municipalities and counties. The states vary in this respect. Meantime the federal part of the program is being partially decentralized, at least insofar as the Social Security Board is concerned, by the establishment of twelve regional offices scattered throughout the country. From a research point of view, the more decentralization there is the more difficult it becomes to obtain uniform data on a nation-wide basis.

Lastly, the organizational structure of social security is rather complex, both in Washington and in the states. In Washington there are the following agencies: the Social Security Board, the Children's Bureau and the Employment Service of the Department of Labor, the Office of Education of the Department of the Interior, and the Public Health Service and the Bureau of Internal Revenue both of the Department of the Treasury. In the states, public assistance is sometimes concentrated in a welfare department, although occasionally there are several independent agencies in this field. Unemployment compensation is usually placed in the State Department of Labor with

* A paper presented to a special meeting of the American Statistical Association with the American Association for the Advancement of Science, the American Sociological Society, and the Sociological Research Association, Denver, June 25, 1937.

the Employment Service associated therein, but this pattern is not universal. In summary, it may be said that the organizational structure of the social security program is so complex that it accentuates the technical problems which already exist.

BASIC STATISTICAL PROBLEMS

Using this description of the administrative structure of social security as a background, let us turn our attention to the statistical and economic problems with which this paper is primarily concerned. The first and most basic problem is that of translating the data which must be assembled for administrative purposes into data which will serve the needs of longer-range research as well as the more immediate needs of public information. In this connection it must be made clear that there will be in the social security program very little collection of data for purely informational purposes. Practically all the data for such purposes must be converted from other uses, and the main difficulties facing us are those incident to such a conversion.

Some idea of the wealth of data which must be collected for the bulk of the working population of the country may be obtained from the following list of items, all of which are required for administration: monthly employment and payrolls by states and by covered industries; in most instances quarterly and annual earnings for each individual worker; length of unemployment for which benefits are paid; amount of benefit payments; and a number of other items of equal value. The question is, can these data be made available to serve general research and informational purposes, or will they be lost in the maze of administration. The problem for a research man is how to provide for forms, methods of procedure, machinery, and other devices which will insure the availability of such administrative data.

I should like to press this point home with a very concrete and specific example—the problem of office machinery. Broadly speaking, economists and statisticians are lamentably ignorant of the operation and uses of office machines. Many research men know nothing whatever about tabulating or bookkeeping equipment. It may surprise some of you to know that the kind of information which will be available to the public on the social security program may be governed fully as much by the office equipment which is adopted in administration as by the quality of the research brains in the field of social security. Thus has technology invaded the most sacred precincts of research!

This question of machinery has been brought to my own personal attention within the past year through the necessity of making a sharp

distinction between statistics and accounting. In the early stages of our work we subscribed whole-heartedly to the principle that statistics are a by-product of accounting, but the year's intensive experience in struggling with this problem has led me now to stress the opposite principle: namely, that the collection and processing of statistics must be an independent operation—independent, that is, of administrative procedure. There is, no doubt, a certain sense in which it is good economy to obtain the data for public information from routine administrative operations. There are, however, such important differences between statistics and accounting that great care is necessary lest the statistics be completely snubbed out of existence.

Let me emphasize briefly the sharp differences which necessarily exist between statistics and accounting. The latter is exact, involving the counting of the last penny; it must deal with the whole universe of items, because the purpose is to account for everything; lastly, its methods are those of addition, that is, the obtaining of counts of totals and sub-totals. The science of statistics, on the other hand, operates on an entirely different basis: it need only be approximate, not exact; it can work through samples rather than using the universe; and its methods are largely those of classifying and grouping comparable items. The conclusion is that statistical work requires an independent set-up, with machinery and tabulating equipment suitable to its processes. In other words, the statisticians must be properly implemented to perform the tasks which are required of them. There must be a fruitful union of technology and brains if we are to get the best results in this new field of research.

TECHNICAL PROBLEMS

We come now to a second group of knotty problems; namely, those of a technical and statistical character. In public assistance, for example, there is the problem of coordinating the data for a bewildering variety of programs so as to produce a unified and consistent whole. This is the field in which we have had, either concurrently or successively, such programs as the Federal Emergency Relief Administration, the Civil Works Administration, the Local Works Division, the Works Progress Administration, the Resettlement Administration, the National Youth Administration, Social Security, and a variety of others. It is this wide variety which in itself is partly responsible for the fact that it has never been possible to estimate with accuracy the number of persons and families dependent on public and private assistance throughout this last depression.

At the present time a determined effort is being made to develop some statistical series which will present a unified picture of the whole relief and welfare program of the nation. In the Bureau of Research and Statistics of the Social Security Board we are now, in addition to our regular series on *public assistance* to the aged, the blind, and to dependent children, also compiling data on total *relief* and *assistance* expenditures in 118 urban centers; this is a series which was taken over from the Children's Bureau of the Department of Labor. In addition, we have a rural series covering all expenditures in 335 rural counties scattered throughout the country. This series has just been taken over from the Works Progress Administration, which originated it about two years ago. Both the urban and the rural series, which are based on sample cities and counties, represent *all types of expenditures, public and private,* in each of the selected communities. A third series is that on *general relief* in the states, the data being collected from state and county relief administrations or welfare departments. This series has been carried on for the past year in collaboration with the Works Progress Administration, but has recently been taken over by the Social Security Board. Out of all these different series, it is hoped that eventually a unified picture of the relief and assistance situation in the United States can be presented.

In the field of unemployment compensation there are a number of special problems, the most important of which exists in employment and payrolls. For a number of years the Bureau of Labor Statistics of the Department of Labor has been compiling statistics of employment and payrolls in manufacturing and non-manufacturing industries. The original data consist of reports made once a month by sample firms in the respective industries. Employment is reported as the number of persons listed on the weekly (or other type of) pay period ending nearest the fifteenth of the month, while the dollars of payroll represent the wages earned in that pay period by these employees. The two sets of figures—employment on the one hand, payroll on the other—are complementary to each other and are closely comparable.

In unemployment compensation we obtain the total wages earned for the month by all covered employees, both manual and clerical, on all types of pay periods—weekly, semi-monthly, monthly, or others. The report on dollars of payroll is, therefore, more comprehensive than the similar report of the Bureau of Labor Statistics in that it covers all wages earned during a given period of time. The difficulty is that there is no very satisfactory way of determining the number of employees which should be related to this amount of payroll. The figure which is theoretically the most nearly exact is the arithmetic average of the

numbers of persons appearing on all different types of payrolls during the month. But this is a figure which is cumbersome to compute. As an alternative, we have been experimenting with the idea of using the number of persons appearing on all types of payrolls at a certain period in the month; say, for example, the numbers represented on all payrolls ending nearest the fifteenth of the month, or the numbers represented on the last payrolls ending within the month. However, such a figure is relatively independent of the total dollars of payroll earned during the month and, therefore, we do not have in our unemployment compensation program the close tie-up which exists in the Bureau of Labor Statistics between employment on one hand and payrolls on the other. We select what amounts to two different types of figures, hoping that the relationship between the two will be close enough to enable us to use them together, although not for the same broad purposes as can be done with the Bureau of Labor Statistics series.

Still another illustration arises from these same figures. The Bureau of Labor Statistics, selecting a single week in a given month, is not worried about a differing length of the month. They can easily obtain monthly indexes having the character of a trend. We, on the other hand, obtain payrolls for the entire month and, therefore, our months are not strictly comparable with each other, if in one there are only four weekly payrolls while in the next there are five such payrolls. Thus, while we have obtained a wealth of data far beyond that previously available in this field, the disturbing factor is that this has been accomplished by a loss of precision which is going to cause considerable difficulty to statisticians and economists.

Still another problem in unemployment compensation is deserving of some attention. Most of the state laws provide for a merit-rating for employers, based upon their respective experiences in stabilization of employment. We do not yet know exactly what form this merit-rating will take, but there is the clear implication that in some instances, at least, the nature of the industry will be taken into account in determining an employer's record of stabilization. Therefore, the classification of industries which is adopted by Social Security will be very important for unemployment compensation purposes, and we may be sure in turn that the operation of merit-rating systems in unemployment compensation will produce a marked effect upon industrial classification systems in use in this country.

Finally, in the field of old-age benefits there are a few technical problems which require mentioning in this connection. Through the reporting system established for old-age benefit purposes we shall have available quarterly and annual earnings of individual workers on a scale

never before witnessed in this or any other country. The statistical value of these data is somewhat impaired by the fact that these earnings reports cover the earnings of individuals up to $3000 per year only. There is the additional complication that these earnings reports differ from those in unemployment compensation, which cover all earnings, including those over $3000.

Undoubtedly the biggest problem faced in old-age benefits is that of record-keeping, which must extend over a period, in some instances, of half a century for given individual workers. The technical and statistical difficulties involved in such extensive, long-range record-keeping constitute a challenge to the newly-developed office equipment industry, as well as to the accountants and statisticians who must plan for the keeping of these data.

ECONOMIC PROBLEMS

In the third group of social security problems are those of a long-range economic character. It is necessary here only to call attention to a few of these which present immediate difficulty.

In public assistance one of the outstanding problems grows out of the provision that the states must finance their share of the cost. This problem has both an economic and fiscal aspect. In some instances the fiscal situation in the individual states is such as to place a decided limitation upon their participation. Lack of adequate taxation or of borrowing power may prevent the state from raising the required funds to match the federal grant. But even more important is the question of basic economic resources—whether the state has the wealth to support the tax load which would be required to carry a public assistance program. (Some states have been exceptionally liberal in providing funds for recipients.) There are some fundamental issues of relative state capacity to pay which have not yet fully come to light but which are rapidly developing.

Another feature of public assistance involves the relationship existing between the scale of payments to individuals under old-age assistance with the benefit schedules laid down in the Act for old-age benefits. The fact is that for some years to come the payments to needy aged individuals will be more generous than the typical benefits payable under old-age insurance. This paradox will require early attention.

In unemployment compensation the problem of what to do with a man who is not working because of illness will arise as soon as benefit payments begin. Such an individual is not entitled to draw unemploy-

ment compensation benefits because he is not available for work, and yet the family in which the wage earner is unemployed because of illness is fully as much in need of benefits as the family in which the wage earner is only out of a job. As more and more beneficiaries are deprived of their unemployment benefits because of inability to work, there will be stronger and stronger pressure to include within that benefit system an equivalent set of benefits for sickness or temporary disability.

A little later on, a second problem will arise in connection with those beneficiaries who will have exhausted their rights. When a worker has drawn compensation benefits for a period of thirteen to sixteen weeks, whichever the case may be, he is no longer eligible. But if he still continues to be unemployed, he will undoubtedly question the action of the insurance administration in cutting off his rights to benefits. So long as the number of such individuals is small, the question may be avoided. But in any serious depression in which substantial numbers of workers lose their benefit rights and enter the post-benefit period of unemployment, we may be sure that a strong movement will arise for the continuation of benefits. It is this situation which gave rise to the familiar "extended benefits" of the British system. Some plan for a work program or for an extended benefit grant of some kind will have to be devised in advance of the next depression.

In old-age benefits the problem which has engrossed the attention of critics to the exclusion of almost all others is that of the reserve. The system as at present constituted provides for the establishment of a full reserve. The reasoning back of such a system need not be examined here. It is sufficient to point out that the issue of a full reserve as against a pay-as-you-go policy will be debated extensively during the next few years.

Another difficulty arises from the fact that old-age benefits are not paid on any large scale until 1942. The theory behind this delay is that the beneficiaries must make contributions over a limited period of time before they are eligible for benefits; for the present Act constitutes essentially a contributory system. The question is whether some system can be devised for paying benefits earlier than 1942 and yet maintain the fundamentals of a contributory system.

Still again there is the question as to whether or not a flat-rate benefit might be preferable to the present method. Simply paying a flat amount, say $30 or $40 a month, to all contributors is very appealing to those who are impressed with the administrative difficulties of the present system. On the other hand, anyone who takes thought of

the wide differences in standards of living, costs, wages, and in other related factors throughout the United States will realize that a flat benefit payment which would be reasonable in one section might be totally inadequate in another.

This paper does little more than raise questions. It offers no solutions for the basic, technical, and long-range economic problems which are here set forth. However, if these difficulties are seriously faced by social scientists everywhere, and more particularly by statisticians, economists, and administrators who are at work in the social security program, then we may at least have laid a foundation for tackling these problems.

In summary, I should like to say that the social security program is not really an alien principle grafted upon the functioning economic system—in fact, quite the opposite. The social security program, as now written, is readily adaptable to our economic life. I think it is more important at this stage of development to stress its protective features, its insurance aspects, and its lack of serious interference with basic economic practices, than to emphasize its preventive and curative values. It is possible that unemployment compensation, for example, may diminish unemployment and that old-age benefits will lead to increased savings for old age. But the really important point is that social security represents an attempt to protect the individual and to insure him against some of the hazards of our modern economic system without interfering with the ordinary operation of that system. Hence social security may turn out to be a device which will reinvigorate our existing economic system.

ON THE SIMULTANEOUS DETERMINATION OF THE ELEMENTARY REGRESSIONS AND THEIR STANDARD ERRORS IN SUBSETS OF VARIABLES*

By Jacob L. Mosak
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In a recent article on the determination of multiple regression constants[1] F. V. Waugh developed a method of deriving the statistical measures of relationship in a set of m variables in terms of the values $P_{ij}=\Delta_{ij}/\Delta$, where Δ_{ij} is the cofactor of r_{ij} in the zero order correlation matrix, and Δ is the determinant value of that matrix. If the variables are expressed in terms of standard deviation units ($z_i=x_i/\sigma_i$), the regression equations become:

$$(1) \qquad z_i = \beta_{i1}z_1 + \cdots + \beta_{ij}z_j + \beta_{ik}z_k + \cdots + \beta_{im}z_m .$$

The problem is to determine the β's and their standard errors, and to adjust them for the omission of a variable. Designating by n the number of sets of observations and by m the number of variables we have,

$$(2) \quad \beta_{ij} = -P_{ij}/P_{ii} ,$$

$$(3) \quad r_{ij} = (\beta_{ij}\beta_{ji})^{1/2} = \frac{-P_{ij}}{(P_{ii}P_{jj})^{1/2}} \quad \text{(Coefficient of partial correlation).}$$

$$(4) \quad \overline{S}_i = (1/P_{ii})^{1/2} \quad \text{(Standard error of estimate),}$$

$$(5) \quad \bar{\epsilon}_i = \left(\frac{n}{n-m}\overline{S}_i^{\,2}\right)^{1/2} \quad \text{(Quadratic mean error),}$$

$$(6) \quad R_i = (1-\overline{S}_i^{\,2})^{1/2} \quad \text{(Coefficient of multiple correlation), and}$$

$$(7) \quad R_i' = \left(1-\frac{n-1}{n-m}\overline{S}_i^{\,2}\right)^{1/2} \quad \text{(Adjusted coefficient of multiple correlation).}$$

The quantities ${}_ic_{jk}$ necessary in order to compute the standard errors of the parameters as well as of the function[2] are given by the equation:

* I wish to thank Professor Henry Schultz for his encouragement, without which this article would not have been written.

[1] Frederick V. Waugh, "A Simplified Method of Determining Multiple Regression Constants," this Journal, 30 (1935), pp. 694–700.

[2] For an explanation of the standard error of a function, see Henry Schultz, "The Standard Error of a Forecast from a Curve," this Journal, 25 (1930), pp. 139–185.

The quantities ${}_ic_{jk}$ correspond to the quantities $[\alpha\alpha]$, $[\beta\beta]$, $\cdots$, $[\mu\mu]$, $[\alpha\beta]$, $\cdots$, $[\alpha\mu]$, in Professor Schultz's symbols. It should be noted, however, that Professor Schultz deals with original and not with standard deviation units.

(8-a) $$ {}_{i}c_{jk} = (P_{ii}P_{jk} - P_{ij}P_{ik})/(nP_{ii}) . $$

With the aid of an elementary theorem in determinants, which states that

(9) $$ \Delta\Delta_{ijkl} = \Delta_{ij}\Delta_{kl} - \Delta_{il}\Delta_{jk} , $$

it may be seen that (8-a) readily reduces itself to the more familiar form:

(8-b) $$ {}_{i}c_{jk} = \Delta_{iijk}/(n\Delta_{ii}) . $$

The variance of β_{ij} is given by:

(10) $$ \sigma^2_{\beta_{ij}} = \bar{\epsilon}_i^2({}_{i}c_{jj}) = \frac{n\overline{S}_i^2}{n-m} \frac{P_{ii}P_{jj} - P^2_{ij}}{nP_{ii}} = \frac{P_{ii}P_{jj} - P^2_{ij}}{(n-m)P^2_{ii}} . $$

The P_{ij} values may of course be computed by the long-hand method of evaluation of a determinant and its cofactors. In Professor Schultz's statistical laboratory, however, we have found it convenient since the beginning of 1936 to use a modified form of Gauss's method of substitution for the solution of the P_{ij} values. This form, including the directions for solution, is shown in Tables IA and IB.[3] It yields all the elements $P_{ij}=\Delta_{ij}/\Delta$ of the reciprocal matrix. It differs from the so-called Doolittle form for solving normal equations in that there is no separate column involving the dependent variable. In this table each of the variables may in turn be considered as the dependent variable and its regression on the remaining variables be determined by means of the P_{ij} values.

It is an added advantage of this method that the quantities ${}_{m}c_{jk}$ and ${}_{m-1}c_{jk}$ for the regressions of the m^{th} and the $m-1^{\text{th}}$ variables on the remaining ones may be readily obtained from the computation sheet without recourse to equation (8-a).[4] This is quite important, for in many types of problems some of the elementary regressions do not make sense. Thus in the determination of demand functions in which "time," t, is used as an explicit variable, the regression of t on the remaining variables is generally meaningless.

The computational procedure may be easily seen from our illustration of four variables. The quantities $n({}_{4}c_{jk})$ for the regression of z_4 on z_1, z_2, and z_3 are simply the elements $(\Delta_{44jk}/\Delta_{44})$ of the reciprocal matrix formed from the zero order correlations of the three independent variables z_1, z_2, and z_3. They may therefore be obtained from Table IA by

[3] I am indebted to Professor Schultz for his permission to use these tables in connection with this note.

[4] Actually the solution is in terms of $n({}_{m}c_{jk})$ and $n({}_{m-1}c_{jk})$, instead of ${}_{m}c_{jk}$ and ${}_{m-1}c_{jk}$.

blocking out the terms involving z_4, and solving in exactly the same manner as we would for P_{jk} in a three-variable problem. Thus:
From line 11:

$$n({}_4c_{33}) = \Delta_{3344}/\Delta_{44} ,$$
$$n({}_4c_{23}) = \Delta_{2344}/\Delta_{44} ,$$
$$n({}_4c_{13}) = \Delta_{1344}/\Delta_{44} ;$$

from line 6:

$$n({}_4c_{22}) = (\Delta_{2344}/\Delta_{3344})n({}_4c_{23}) + 1/\Delta_{3344} ,$$
$$n({}_4c_{12}) = (\Delta_{2344}/\Delta_{3344})n({}_4c_{13}) - r_{12}/\Delta_{3344} ;$$

and from line 2:

$$n({}_4c_{11}) = - r_{12}n({}_4c_{12}) - r_{13}n({}_4c_{13}) + 1 .$$

By similar reasoning, it follows that we may compute the quantities $n({}_3c_{jk})$ by blocking out from Table IA all terms involving z_3. It is convenient for this purpose to add a line: 14B $= -\Delta_{3344}/\Delta_{33}$ times line 14A of Table IA. Solving as in Table IB we then obtain:
From line 14B:

$$n({}_3c_{44}) = \Delta_{3344}/\Delta_{33} ,$$
$$n({}_3c_{24}) = - \Delta_{2334}/\Delta_{33} ,$$
$$n({}_3c_{14}) = - \Delta_{1334}/\Delta_{33} ;$$

from line 6:

$$n({}_3c_{22}) = - (\Delta_{2334}/\Delta_{3344})n({}_3c_{24}) + 1/\Delta_{3344} ,$$
$$n({}_3c_{12}) = - (\Delta_{2334}/\Delta_{3344})n({}_3c_{14}) - r_{12}/\Delta_{3344} ;$$

and from line 2:

$$n({}_3c_{11}) = - r_{12}n({}_3c_{12}) - r_{14}n({}_3c_{14}) + 1 .$$

It is important to note that the values $n({}_ic_{jk})$ are not only the weights necessary in computing the standard error of the function but that they are also equal to the P_{jk} values in the subset of variables in which z_i is omitted. This has already been illustrated in the solution of the quantities $n({}_4c_{jk})$, which, we have seen, are equal to $P_{jk(4)}$. (The subscript in parentheses indicates an omitted variable.) The proof is simple. By definition P_{jk} in the subset of variables omitting z_i is

(11) $$P_{jk(i)} = \Delta_{jkii}/\Delta_{ii} = (P_{jk}P_{ii} - P_{ij}P_{ik})/P_{ii}$$ (See equation (9).)

But this is also the definition of $n({}_ic_{jk})$ as given by (8).[5] The values

[5] In his note, "The Analysis of Regression in Subsets of Variables," This JOURNAL, 31 (1936), pp. 729–730, F. V. Waugh defines

$$P_{jk(i)} = \Delta_{jkii}/\Delta = P_{jk}P_{ii} - P_{ij}P_{ik}.$$

It is obvious that the $P_{jk(i)}$ values, so defined, are not analogous to his P_{jk} values. In fact, with his

TABLE IA. FORM FOR THE SIMULTANEOUS EVALUATION OF THE RELATED PARAMETERS IN TERMS OF THE

Line No.	Directions	Reciprocals	A	B	C	D
I			1	r_{12}	r_{13}	r_{14}
II				1	r_{23}	r_{24}
III					1	r_{34}
IV						1
1	I		1	r_{12}	r_{13}	r_{14}
2	$-(1)$	-1	-1	$-r_{12}$	$-r_{13}$	$-r_{14}$
3	II			1	r_{23}	r_{24}
4	$-r_{12}\cdot(1)$			$-r_{12}^2$	$-r_{12}r_{13}$	$-r_{12}r_{14}$
5	$(3)+(4)$			Δ_{3344}	$-\Delta_{2344}$	Δ_{2334}
6	$\frac{-1}{\Delta_{3344}}(5)$	$\frac{-1}{\Delta_{3344}}$		-1	$\frac{\Delta_{2344}}{\Delta_{3344}}$	$\frac{-\Delta_{2334}}{\Delta_{3344}}$
7	III				1	r_{34}
8	$(-r_{13})\cdot(1)$				$-r_{13}^2$	$-r_{13}r_{14}$
8A	$(7)+(8)$				Δ_{2244}	$-\Delta_{2234}$
9	$\frac{\Delta_{2344}}{\Delta_{3344}}\cdot(5)$				$\frac{-(\Delta_{2344})^2}{\Delta_{3344}}$	$\frac{\Delta_{2344}\cdot\Delta_{2334}}{\Delta_{3344}}$
10	$(8A)+(9)$				$\frac{\Delta_{44}}{\Delta_{3344}}$	$\frac{-\Delta_{34}}{\Delta_{3344}}$
11	$\frac{-\Delta_{3344}}{\Delta_{44}}\cdot(10)$	$\frac{-\Delta_{3344}}{\Delta_{44}}$			-1	$\frac{\Delta_{34}}{\Delta_{44}}$
12	IV					1
13	$(-r_{14})\cdot(1)$					$-r_{14}^2$
13A	$(12)+(13)$					Δ_{2233}
14	$\frac{-\Delta_{2334}}{\Delta_{3344}}\cdot(5)$					$\frac{-(\Delta_{2334})^2}{\Delta_{3344}}$
14A	$(13A)+(14)$					$\frac{\Delta_{33}}{\Delta_{3344}}$
15	$\frac{\Delta_{34}}{\Delta_{44}}\cdot(10)$					$\frac{-(\Delta_{34})^2}{\Delta_{44}\Delta_{3344}}$
16	$(14A)+(15)$					$\frac{\Delta}{\Delta_{44}}$
17	$\frac{-\Delta_{44}}{\Delta}(16)$	$\frac{-\Delta_{44}}{\Delta}$				-1

COEFFICIENTS IN ALL OF THE REGRESSION EQUATIONS AND CORRELATION DETERMINANT AND ITS COFACTORS

R	S	T	U	Sum-Check		Line No.
-1	0	0	0	Σ_1		I
0	-1	0	0	Σ_2		II
0	0	-1	0	Σ_3		III
0	0	0	-1	Σ_4		IV
-1	0	0	0	Σ_1	$\surd$	1
1	0	0	0	$-\Sigma_1$	$\surd$	2
0	-1	0	0	Σ_2		3
r_{12}	0	0	0	$-r_{12}\cdot\Sigma_1$		4
r_{12}	-1	0	0	Σ_2	$\surd$	5
$\frac{-r_{12}}{\Delta_{2344}}$	$\frac{1}{\Delta_{3344}}$	0	0	$\frac{-\Sigma_2'}{\Delta_{2344}}$	$\surd$	6
0	0	-1	0	Σ_3		7
r_{13}	0	0	0	$-r_{13}\cdot\Sigma_1$		8
r_{13}	0	-1	0	$\Sigma_3-r_{13}\cdot\Sigma_1$		8A
$\frac{\Delta_{2344}\cdot r_{12}}{\Delta_{3344}}$	$\frac{-\Delta_{2344}}{\Delta_{3344}}$	0	0	$\frac{\Delta_{2344}}{\Delta_{3344}}\cdot\Sigma_2'$		9
$\frac{-\Delta_{1344}}{\Delta_{3344}}$	$\frac{-\Delta_{2344}}{\Delta_{3344}}$	-1	0	Σ_3'	$\surd$	10
$\frac{\Delta_{1344}}{\Delta_{44}}$	$\frac{\Delta_{2344}}{\Delta_{44}}$	$\frac{\Delta_{3344}}{\Delta_{44}}$	0	$\frac{-\Delta_{3344}}{\Delta_{44}}\cdot\Sigma_3'$	$\surd$	11
0	0	0	-1	Σ_4		12
r_{14}	0	0	0	$-r_{14}\cdot\Sigma_1$		13
r_{14}	0	0	-1	$\Sigma_4-r_{14}\cdot\Sigma_1$		13A
$\frac{-\Delta_{2334}\cdot r_{12}}{\Delta_{3344}}$	$\frac{\Delta_{2334}}{\Delta_{3344}}$	0	0	$\frac{-\Delta_{2334}}{\Delta_{3344}}\cdot\Sigma_2'$		14
$\frac{\Delta_{1334}}{\Delta_{3344}}$	$\frac{\Delta_{2334}}{\Delta_{3344}}$	0	-1	$\Sigma_4-r_{14}\cdot\Sigma_1-\frac{\Delta_{2334}}{\Delta_{3344}}\Sigma_2'$		14A
$\frac{-\Delta_{24}\Delta_{1344}}{\Delta_{44}\Delta_{3344}}$	$\frac{-\Delta_{24}\Delta_{2344}}{\Delta_{44}\Delta_{3344}}$	$\frac{-\Delta_{24}}{\Delta_{44}}$	0	$\frac{\Delta_{24}}{\Delta_{44}}\Sigma_3'$		15
$\frac{-\Delta_{14}}{\Delta_{44}}$	$\frac{-\Delta_{24}}{\Delta_{44}}$	$\frac{-\Delta_{34}}{\Delta_{44}}$	-1	Σ_4'	$\surd$	16
$\frac{\Delta_{14}}{\Delta}$	$\frac{\Delta_{24}}{\Delta}$	$\frac{\Delta_{34}}{\Delta}$	$\frac{\Delta_{44}}{\Delta}$	$\frac{-\Delta_{44}}{\Delta}\Sigma_4'$	$\surd$	17

$n({}_{i}c_{jk})$ may therefore be used in the same manner as the P_{jk} values to determine all the regression constants in the subset of variables in which z_i is omitted.

TABLE IB. SOLUTION FOR $P_{ij}=\frac{\Delta_{ij}}{\Delta}$

From line 17	$P_{44}=\frac{\Delta_{44}}{\Delta}$ $\quad P_{24}=\frac{\Delta_{24}}{\Delta}$ $P_{34}=\frac{\Delta_{34}}{\Delta}$ $\quad P_{14}=\frac{\Delta_{14}}{\Delta}$
From line 11	$P_{33}=\frac{\Delta_{34}}{\Delta_{44}}\cdot P_{34}+\frac{\Delta_{2344}}{\Delta_{44}}$ $P_{23}=\frac{\Delta_{34}}{\Delta_{44}}\cdot P_{24}+\frac{\Delta_{2344}}{\Delta_{44}}$ $P_{13}=\frac{\Delta_{24}}{\Delta_{44}}\cdot P_{14}+\frac{\Delta_{1344}}{\Delta_{44}}$
From line 6	$P_{22}=\frac{-\Delta_{2244}}{\Delta_{3344}}\cdot P_{23}+\frac{\Delta_{2234}}{\Delta_{3344}}\cdot P_{24}+\frac{1}{\Delta_{3344}}$ $P_{12}=\frac{-\Delta_{2244}}{\Delta_{3344}}\cdot P_{13}+\frac{\Delta_{2334}}{\Delta_{3344}}\cdot P_{14}-\frac{r_{12}}{\Delta_{3344}}$
From line 2	$P_{11}=-r_{12}\cdot P_{12}-r_{13}\cdot P_{13}-r_{14}\cdot P_{14}+1$

Before proceeding to compute a regression equation and its descriptive constants we may want to know whether a given variable z_j, will prove statistically significant. Whether a variable is significant or not is a matter for the statistical analyst to determine in each particular problem in the light of any relevant knowledge which he may possess. In the absence of any knowledge to the contrary, the statistician will generally do well to omit from consideration any variable for which the regression coefficient is smaller than its standard error. The omission of such a variable will always increase the value of R', and the new curve may therefore be considered as giving an improved fit to the data. Stated algebraically, this criterion means that z_j may be

definition it is no longer true as he says that $R^2_{j(i)}=1-(1/P_{jj(i)})$. The equations for the β coefficients and their variances, however, do hold true even for his definitions, since the denominators cancel.

It was Professor R. A. Fisher who first proposed the method of adjusting the regression coefficients for the omission of a variable. Working under the direction of Professor Schultz, Mr. Milton Friedman extended this method to the adjustment of the weights of the parameters. This procedure was the one used before our form for obtaining the P_{jk} values was developed. Since then we have used equation (11) to adjust the P_{jk} values for the omission of a variable z_i. All our regression constants in the subset of $m-1$ variables are then obtained in terms of the $P_{jk(i)}$ values.

omitted from the regression in which z_i is the dependent variable, if:

(12-a) $$\sigma^2_{\beta_{ij}} > \beta^2_{ij} ,$$

or by (10), if

(12-b) $$(P_{ii}P_{jj} - P^2_{ij})/n'P^2_{ii} > \beta^2_{ij} \qquad (n' = n - m) .$$

This inequality reduces to

(12-c) $$P_{jj}/P_{ii} - \beta^2_{ij} > n'\beta^2_{ij} ,$$

which in turn simplifies into the following forms:

(13-a) $$P_{jj}/P_{ii} > (n' + 1)\beta^2_{ij} ,$$

(13-b) $$P_{jj} > (n' + 1)\left| P_{ij}\beta_{ij} \right| ,$$

(13-c) $$P_{jj}P_{ii} > (n' + 1)P^2_{ij} ,$$

(13-d) $$1 > (n' + 1)\beta_{ij}\beta_{ji} , \qquad \text{and}$$

(13-e) $$1 > (n' + 1)r^2_{ij} .$$

If we use as a test of significance the inequality

$$\sigma^2_{\beta_{ij}} > k\beta^2_{ij} ,$$

the inequalities above still hold but with kn' substituted for n'. This is a relatively simple test which may in most cases be applied mentally.[6] It is given here not so much because it is labor saving—it involves only the terms in the numerator of σ^2 [compare (10) and (13-c)] and can be applied mentally before computing either β or σ—but in order to shed some additional light on the conditions for the statistical significance of a variable. This is especially true of formulas (13-d) and (13-e) which can be used even when the regressions are determined by some other method than that given here and when the computations of the standard errors are more time-consuming. More important, still, is the fact that from the symmetrical form of (13-c), (13-d) and (13-e) it follows that if β_{ij} is significant (or not significant), β_{ji} is also significant (or not significant).

If two variables prove statistically insignificant we may want to know whether one of them will become significant when the other is omitted. The omission of one variable would increase $n'(=n-m)$ by 1, so that our test of significance may be stated as follows:

The variable z_j will be insignificant when z_k is omitted from the regression in which z_i is the dependent variable, if:

(14-a) $$1 > (n' + 2)\beta_{ij(k)}\beta_{ji(k)} ,$$

[6] The test was developed independently by Dr. Y. K. Wong and myself. Formulas (13-d) and (13-e) are due to him.

$$(14\text{-b}) \qquad 1 > (n' + 2)({}_kc_{ij})^2/({}_kc_{jj}\,{}_kc_{ii}) ,$$

$$(14\text{-c}) \qquad 1 > (n' + 2)\frac{(P_{ij}P_{kk} - P_{ik}P_{jk})^2}{(P_{jj}P_{kk} - P^2_{jk})(P_{ii}P_{kk} - P^2_{ik})} .$$

It may be well at this stage to attempt to give some meaning to the P_{ij} values other than the purely statistical definition: $P_{ij}=\Delta_{ij}/\Delta$. It will be most convenient to use an illustration of four variables. Let:

$$(15) \qquad \begin{cases} v_1 = z_1 - \beta_{12}z_2 - \beta_{13}z_3 - \beta_{14}z_4 \\ v_2 = z_2 - \beta_{21}z_1 - \beta_{23}z_3 - \beta_{24}z_4 . \end{cases}$$

Then it can easily be shown that

$$(16) \qquad P_{12} = \frac{\Sigma v_1 v_2}{n} \Big/ \left(\frac{\Sigma {v_1}^2}{n}\ \frac{\Sigma {v_2}^2}{n}\right).$$

In words, this formula states that P_{12} is the ratio of the covariance of the residual variates v_1 and v_2 to the product of their variances. It follows that the absolute value of β_{12} $(=P_{12}/P_{11})$ is the ratio of the covariance of the variates v_1 and v_2 to the variance of v_2. The proof is simple:

$$(17) \qquad \Sigma v_1 v_2/n \equiv \Sigma(z_1 - \beta_{12}z_2 - \beta_{13}z_3 - \beta_{14}z_4)v_2/n .$$

By the least squares curve-fitting procedure we have

$$(18) \qquad \Sigma v_2 z_1 = \Sigma v_2 z_3 = \Sigma v_2 z_4 = 0 , \quad \text{and}$$

$$(19) \qquad \Sigma v_2 z_2 = \Sigma {v_2}^2 .$$

Substituting equations (18) and (19) in equation (17), we have:

$$(20) \qquad \Sigma v_1 v_2/n = -\beta_{12}\Sigma {v_2}^2/n,$$

from which it follows that

$$(21) \qquad \frac{\Sigma v_1 v_2}{n} \Big/ \left(\frac{\Sigma {v_1}^2}{n}\ \frac{\Sigma {v_2}^2}{n}\right) = -\beta_{12}\frac{\Sigma {v_2}^2}{n} \Big/ \left(\frac{\Sigma {v_1}^2}{n}\ \frac{\Sigma {v_2}^2}{n}\right)$$

$$= -\beta_{12}P_{11} = P_{12} .$$

Whether this interpretation of P_{ij} will prove fruitful remains to be seen.

CORRELATION BETWEEN MEANS AND STANDARD DEVIATIONS IN FIELD EXPERIMENTS*

By F. R. Immer
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Studies of association between means and standard deviation of plots in field experiments are of both theoretical and practical interest. It is well known that means and standard deviations of random samples drawn from a normal, homogeneous population are independent. Does the same property of independence hold for yield data from agronomic experiments?

Fisher, Immer and Tedin (3)[1] studied the association between means and variances (k_1 and k_2) of 16 height measurements of barley plants selected at random from each of 24 plots having received different nitrogenous fertilizers. The covariance of k_1 and k_2 was -14.37 ± 13.27, a negative value but non-significant. Eden and Yates (2) used 32 height measurements from each of 8 blocks of wheat and found a negative covariance between k_1 and k_2, within blocks, of -187.26. A negative skewness was indicated in both studies due to what may be termed a ceiling effect tending to give smaller errors at the high end of the height range.

Arny and Steinmetz (1) obtained data on the yields of 10 square yard samples harvested from each of three replicated plots in a test of six fertilizer treatments. Seven such tests, with different crops or at different places, were carried out in exactly the same way. The mean yield and standard deviation of the 10 square yard samples was calculated for each plot. Means and standard deviations were then correlated, the correlation for the interaction of blocks×varieties, or error component, being used. This correlation would then measure the associations between means and standard deviations with the block and treatment effect eliminated. The results are given in Table I. In this, and other tables, $\bar{x}$ is used to represent the mean and s represents the standard deviation.

These correlation coefficients are based on 10 degrees of freedom each. Only one is significant, that of the first wheat experiment at

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[1] The numbers in brackets refer to the references cited on p. 531.

University Farm. Six of the seven coefficients were negative. The average correlation coefficient, obtained by transforming r to Fisher's z, averaging z and changing back to r, was $-.291$, a significant value. A tendency for plots of high yield to have a lower error than plots of low yield is evident in these tests.

TABLE I

CORRELATION OF MEANS AND STANDARD DEVIATIONS OF PLOTS FROM DATA BY ARNY AND STEINMETZ

Place of Test	Crop	Mean yield in bu. per acre	Correlation of $\bar{x}$ and s
University Farm	Rye	25.57	−.530
University Farm	Wheat	35.82	−.614**
University Farm	Wheat	29.70	−.133
Morris	Wheat	18.91	+.521
Morris	Wheat	22.47	−.259
Morris	Wheat	28.34	−.474
Waseca	Barley	33.39	−.431
Average			−.291

** Highly significant.

Montgomery (7) provided data on 224 plots of wheat, from a uniformity trial, 5.5×5.5 feet in size. Combining these plots into groups of 8, to provide small blocks, the correlation between means and standard deviations from 28 such blocks was $-.233$. Mercer and Hall (6) published yields of 500 plots of wheat from a uniformity trial. Each plot was 1/500 acre in size. These were combined into blocks of 10 plots each and the means and standard deviations correlated. From these data the correlation coefficient was $-.078$. The correlation coefficients were negative in both cases but non-significant. These results are in accord with those obtained from data by Arny and Steinmetz (1) and with the results from height measurements reported by Fisher, Immer and Tedin (3) and by Eden and Yates (2).

Wiebe (8) published yields of 1500 rod rows of wheat in a uniformity trial. These data were grouped into 60 plots of 24 adjacent rod rows each. Ten such plots were taken as a block and the correlation obtained between mean and standard deviations of such plots within blocks. The coefficients of correlations are given in Table II.

The correlation within blocks, of $+.480$, is highly significant. The

TABLE II

CORRELATION OF MEANS AND STANDARD DEVIATIONS OF PLOTS (24 ROD ROWS EACH) FROM WIEBE'S DATA

Variation	Degrees of freedom	Correlation of $\bar{x}$ and s
Between blocks	5	+.899*
Within blocks	54	+.480**
Total	59	+.590**

* Significant.
** Highly significant.

results from these data are not in accord with those previously referred to. Apparently the tendency toward a negative correlation between means and standard deviations of plots of the same material is not universal. A negative correlation might be expected, on theoretical grounds, and usually seems to be the case but exceptions to this rule may be expected.

Hayes and Immer (4) studied the association between mean yield and probable error in replicated rod row variety tests with cereal crops. They separated the varieties in the different experiments into three groups, viz., those falling within the low, middle or high third of the total range in yield of the varieties in a test. A separated error was calculated for each group within each test. Eight separate experiments were analyzed in this way. These comparisons involved about 450 strains of wheat in replicated yield trials, the probable errors being calculated between plots within varieties. There was a tendency for the probable error in bushels to increase and for the probable error in per cent of the mean to decrease as the yield of the varieties increased. Neither was constant.

Immer (5) studied the correlation between means and standard deviations of replicated rod rows, or small plots, of corn, barley, oats, flax and wheat. The mean and standard deviation were calculated separately for each variety in a given test. The correlation of means and standard deviations between varieties was then computed. It was concluded that as an average of all tests considered, involving 1087 strains or varieties, the standard deviation of these varieties was independent of the mean yield of the varieties. The data covered the range in yield encountered in practical variety trials in small plots.

In the study reported by Immer (5) the same 62 strains of wheat were tested at each of four stations in Minnesota in 1931 and 50 were tested at the same four stations in 1932. This permitted a further study of correlation between means and standard deviations from analyses of variance and covariance of the same strains in the four tests. The means and standard deviations calculated for each strain in each test were used for this computation. The results are given in Table III.

Only the total correlation is significant. The error correlation is slightly positive but non-significant. The correlation between varieties was very small and negative while the correlation between stations was high and positive. This latter correlation will be referred to later.

In 1932, 50 strains under test were compared in two separate experiments of 25 strains each, at the same four stations. The correlation coefficients for the different components of the variation are given in Table IV.

The correlation for error was negative in this comparison instead of positive as in 1931, but non-significant. The correlation between varieties was positive in 1932 and negative in 1931, being non-significant both years. The correlation between stations was +.642 in 1931 and −.676 in 1932. No generalization can be made for the association between means and standard deviations in different stations. Soil heterogeneity at one station will often be greater than at other stations. If the mean yields happen to be high at the station with inherently more heterogeneous soil this will tend to impart a positive sign to the correlation coefficient. If the mean yield at the same station were low, relatively, this station would tend to impart a minus sign to the correlation between stations.

TABLE III

CORRELATION BETWEEN MEANS AND STANDARD DEVIATIONS OF 62 STRAINS OF WHEAT TESTED AT EACH OF FOUR STATIONS IN 1931

Variations due to	Degrees of freedom	Correlation of $\bar{x}$ and s
Stations	3	+.642
Varieties	61	−.087
Error	183	+.114
Total	247	+.192**

** Highly significant.

TABLE IV

CORRELATION OF MEANS AND STANDARD DEVIATIONS OF 50 STRAINS (TWO GROUPS OF 25) OF WHEAT TESTED AT FOUR STATIONS IN 1932

Variation due to	Degrees of freedom	Correlation of $\bar{x}$ and s
Stations	3	−.676
Groups of varieties	1	
Stations × groups	3	−.146
Varieties within groups	48	+.207
Error	144	−.029
Total	199	−.106

Other types of analyses were attempted also, using data from replicated variety tests with large plots (usually 1/40 acre). These data cover variety tests at six stations in Minnesota and for three different crops; namely, spring wheat, barley and oats. Randomized block analyses of variance were made for each test and the standard deviation for error; i.e., interaction of blocks × varieties, used as the standard deviation of the test. The general mean of the tests was then correlated with the standard error of the tests. The total number of such experiments available was 57 in spring wheat, 73 in barley and 73 in oats; a total of 203 variety tests in large plots.

At the four testing stations located at University Farm, Waseca, Morris and Crookston, data were available from tests for the same seven years in wheat, nine years in barley, and eight years in oats at all four stations. Analyses of variance and covariance gave the cor-

relation coefficients between means and standard deviations of different tests which are shown in Table V.

TABLE V

CORRELATION OF MEANS AND STANDARD DEVIATIONS OF DIFFERENT EXPERIMENTS CONDUCTED AT EACH OF FOUR STATIONS DURING THE SAME YEARS WITH THREE DIFFERENT CROPS

Variation due to	Wheat		Barley		Oats	
	D.F.	r	D.F.	r	D.F.	r
Stations	3	+.785	3	+.446	3	−.084
Years	6	+.042	8	−.389	7	+.511
Error	18	+.122	24	+.129	21	+.061
Total	27	+.201	35	+.151	31	+.130

The correlation coefficients between the average means and standard deviations in the different years as an average of all stations were positive in the case of wheat and oats and negative for barley. None were significant. The correlation coefficients for the error component were small but positive for all three crops. The correlation coefficients between stations were +.78, +.45 and −.08 for wheat, barley and oats, respectively. While none of these are significant the trend is as expected from a knowledge of the general nature of soil heterogeneity at these stations. This may be shown by a comparison of the general means with the average standard deviation for these three crops at each station as in Table VI.

TABLE VI

AVERAGE MEANS AND STANDARD DEVIATIONS FOR EACH OF THREE CROPS

Station	Wheat		Barley		Oats	
	$\bar{x}$	$\bar{s}$	$\bar{x}$	$\bar{s}$	$\bar{x}$	$\bar{s}$
U. Farm	24.69	2.30	41.84	4.72	61.10	4.51
Waseca	24.84	2.29	48.88	4.85	69.73	5.82
Morris	22.57	2.19	35.80	3.15	57.12	5.39
Crookston	26.22	3.34	36.76	5.15	59.44	7.88

Soil heterogeneity at Crookston is greater than at the other three stations, leading to a high error. Crookston produced a higher yield of spring wheat than the other three stations but was next to the lowest in yields of barley and oats. As a consequence, Crookston tends to impart a positive correlation to wheat and a negative correlation to oats and barley, due to its inherently more variable soil.

It seems plain that it would be unwise to attempt to generalize regarding the association between means and standard deviations expected at different stations, even within the same state.

The average means and standard deviations for the data used in the analyses of these four stations are given in Table VII.

TABLE VII

AVERAGE MEANS, STANDARD DEVIATIONS AND COEFFICIENTS OF VARIABILITY OF THE TESTS CONSIDERED IN TABLE V

Variable	Spring Wheat	Barley	Oats
Mean	24.58 bu.	40.82 bu.	61.85 bu.
Standard deviation	2.53 bu.	4.47 bu.	5.90 bu.,
Coefficient of variability	10.3%	11.0%	9.5%

The standard errors in per cent of the mean were relatively constant for these three crops.

Since it does not seem possible to generalize regarding the error to be expected from station to station, it would seem of interest to consider the correlation between years within stations. Other tests not available for the analyses of variance and covariance used for Table V could then be used. These are tests from years in which data were available from less than a full complement of the four stations considered so far, as well as two other stations at which fewer tests were available, i.e., Grand Rapids and Duluth. Such correlation coefficients between years within stations are given in Table VIII.

TABLE VIII

CORRELATION OF MEANS AND STANDARD DEVIATIONS BETWEEN TESTS WITHIN STATIONS FOR THREE DIFFERENT CROPS

Crop	Degrees of freedom	Correlation of $\bar{x}$ and s
Spring wheat	50	+.394**
Barley	66	+.198
Oats	66	+.222

** Highly significant.

The correlation in wheat was highly significant while the correlations for barley and oats were non-significant

In Table IX is given the range in standard deviations and coefficients of variability for the different variety tests of wheat, barley and oats conducted at six stations in Minnesota over a period of years.

Neither the standard errors in bushels (calculated from the error component of randomized block trials) nor the standard errors in per cent of the mean of the tests (C.V.) showed any appreciable degree of constancy in different years at the same station. Variability of the errors in different years is apparently very great.

In conclusion it may be said that from a consideration of the data presented here it appears that an inherent negative correlation exists generally between the mean yield of plots and the standard deviation of samples within such plots for uniformity trial data from field experiments. It appears also that the mean yields and standard deviations of varieties or strains of crop plants tested in replicated field experiments are essentially independent. It appears also very little correlation can be expected between means and standard errors of dif-

TABLE IX

RANGE IN STANDARD ERROR AND COEFFICIENT OF VARIABILITY OF VARIETY TESTS AT EACH OF SIX STATIONS FOR THREE CROPS

Crop and Station	Tests	Range in standard error	Range in C.V.
Spring Wheat			
Univ. Farm	14	1.50– 3.53	6.0–12.1
Waseca	11	1.71– 3.11	6.5–14.4
Morris	9	1.60– 2.84	6.9–15.1
Crookston	9	2.57– 5.11	8.6–26.8
Grand Rapids	9	1.32– 6.11	8.2–20.8
Duluth	5	1.51– 4.90	9.9–27.4
Barley			
Univ. Farm	15	2.70– 8.98	7.7–20.9
Waseca	15	3.29– 8.14	5.8–22.5
Morris	14	1.70– 5.08	4.8–14.7
Crookston	11	3.98– 7.54	8.0–24.6
Grand Rapids	11	2.54– 8.37	9.4–25.0
Duluth	7	2.83– 7.07	9.7–17.9
Oats			
Univ. Farm	15	2.42– 6.39	4.4–15.9
Waseca	12	2.70– 7.98	3.8–19.2
Morris	13	2.55– 7.17	6.3–11.5
Crookston	13	4.67–12.21	7.6–21.2
Grand Rapids	11	2.86–10.03	5.0–24.0
Duluth	9	5.37–15.20	8.2–28.2

ferent experiments conducted in different years or in different parts of the state, under the conditions of these experiments. Consequently, the standard deviation in bushels per acre as calculated from the separate tests would seem to be a more satisfactory measure of variability than would the standard error expressed in percentage of the mean. It was only in the comparisons of the average of the means and standard deviations of three different crops that the coefficient of variability would be preferred.

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NOTES

TEST OF AN OBSERVED DIFFERENCE IN THE FREQUENCY OF TWO RESULTS

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In the analysis of data obtained by sampling, certain problems occur which relate to the significance of apparent differences. Taking any pair of results to which a test may lead, and forming the difference of their respective frequencies observed in a sample, the question arises as to whether this difference is merely an accident of sampling, or whether a similar difference obtains in the universe. Thus if the possible results of a test are A, B, C, etc., A and B may be observed to occur in a sample with proportional frequencies p and p' respectively. If the probabilities, or proportional frequencies in the universe, of A and B are P and P' respectively, the question relates to the significance of the difference $p-p'$, or the extent to which it may differ from the true value $P-P'$.

To this problem there may be applied the same procedure as is used in estimating the significance of the individual frequencies themselves. On the hypothesis that the difference for the universe has some assigned value, there may be estimated the probability of a sample in which the difference deviates from its expected value by as much as that actually observed. If the probability of such a sample is very small, the hypothesis may be rejected, and the conclusion reached that the difference for the universe has some other value than the assigned one.

This is the method of approach employed by Prof. T. H. Brown in an outline of statistical methods adapted to studies of consumer preference.[1] To employ this method, it is necessary to evaluate the standard deviation of the distribution of differences and an expression for this quantity is derived in Prof. Brown's paper. As a preliminary to a discussion of his results, a derivation by another method of the expression for the standard deviation of the differences is given below.

The theoretical problem relates to the distribution of the difference $p-p'$ in samples of size N. Specifically, it is assumed that in the

[1] *The Use of Statistical Techniques in Certain Problems of Market Research.* Business Research Studies, No. 12, May 1935. Harvard University.

universe the probability of A is P and the probability of B is P'. Then the probability of a set of N trials in which A occurs just n times is given by the expression for the Binomial Distribution:

$$P_n(n) = \frac{N!}{n!(N-n)!} P^n(1-P)^{N-n}.$$

Out of the N trials there remain $N-n$ trials in which A does not occur, and in these the probability of B is $P'/(1-P)$. The probability of such a set of $N-n$ trials in which B occurs just m times, $P_{N-n}(m)$, is given by substituting m for n, $N-n$ for N, and $P'/(1-P)$ for P in the above equation. Then the probability of a set of N trials in which A occurs n times and B occurs m times is given by the product $P_N(n) \cdot P_{N-n}(m)$, which may be written:

$$P(m, n) = \frac{N!}{n!m!(N-m-n)!} P^n P'^m (1-P-P')^{N-m-n}.$$

If now d is written for the difference $n-m$, the distribution of d is given by:

$$(1)\quad P(d) = \sum_{n=0}^{N} \frac{N!}{n!(n-d)!(N-2n+d)!} P^n P'^{n-d} (1-P-P')^{N-2n+d}.$$

The arithmetic mean (D) of d is given by $\Sigma d P(d)$, so that by substituting the value of $P(d)$ given by (1) and reversing the order of summation there is obtained:

$$D = \sum_{n=0}^{N} \frac{N!}{n!(N-n)!} P^n \times \sum_{d=n}^{2n-N} \frac{d(N-n)!}{(n-d)!(N-2n+d)!} P'^{n-d} (1-P-P')^{N-2n+d}.$$

By substituting $n-(n-d)$ for d, the second summation may be performed with respect to the variable $n-d$, to which correspond the limits 0 and $N-n$. In this summation the coefficient of n is the binomial expansion of $(1-P)^{N-n}$, while the term in $n-d$ reduces to $(N-n)P'$ multiplied by the binomial expansion of $(1-P)^{N-n-1}$. The remaining summation is similarly performed for the two terms, so that there is finally obtained:

$$(2)\qquad D = N(P-P').$$

The mean difference is therefore the difference of the means.

To evaluate the standard deviation a similar procedure is followed.

The value of $P(d)$ is substituted in:

$$\sigma_d^2 + D^2 = \sum d^2 P(d). \tag{3}$$

In this there is made the substitution:

$$d^2 = (n - d)(n - d - 1) - (2n - 1)(n - d) + n^2.$$

Making the summation with respect to $n-d$ first, as in the preceding case, the three terms on the right of the last equality are employed, the summation in each case being reduced to a binomial expansion. By carrying out the second summation in the same way, (3) is reduced to the form:

$$\sigma_d^2 + D^2 = N(N - 1)P'^2 - 2N(N - 1)PP' + NP' + N(N - 1)P^2 + NP.$$

Substituting in this the value of D given by (2) there is finally obtained

$$\sigma_d^2 = N\{P + P' - (P - P')^2\}. \tag{4}$$

It is of interest to compare this result with that obtained by Prof. Brown. He makes a distinction between cases of limited and unlimited choice, referring to whether the possible number of different results is small or large. In the latter case (unlimited choice) he assumes that in any sample the frequency of one result is independent of the frequency of the other result, and on this basis arrives at an expression for σ_d which reduces to:

$$\sigma_d^2 = N\{P + P' - (P^2 + P'^2)\}. \tag{5}$$

In the other case he does not make make this assumption of independence, and obtains an expression which reduces to (4).

It will be seen that the difference between (4) and (5) lies in the second (quadratic) term, and hence if P and P' are small, the difference becomes negligible and (5) is a valid approximation to (4). Prof. Brown's distinction between the two cases therefore reduces to a distinction between cases in which P and P' are both small, and cases in which they are not. This is a condition which is likely to occur when there are many different results to a test (unlimited choice), as no one result is then likely to have a high frequency (large value of P).

The distinction however, does not correspond in general to that between limited and unlimited choice. Cases may occur where many different results are possible (unlimited choice), but where one particular result occurs with high frequency. In any comparison involv-

ing this result with a large value of P, (5) will not be a good approximation. On the other hand, cases may occur where but three or four different results are possible (limited choice), but where two of the results occur very infrequently, so that in a comparison of these two P and P' are both small, and (5) is a valid approximation. In all cases, however, (4) is applicable and may be used without raising the question as to whether or not (5) is a satisfactory approximation.

In application, the observed difference in frequency in the sample may be compared with that which would be obtained if the difference for the universe had some assigned value. In particular, the hypothesis may be made that the difference for the universe is zero, and the hypothesis tested by determining the ratio of the difference of the sample to σ_d. Using Shewhart's rule, as Prof. Brown does, the hypothesis is rejected if this ratio is greater than 3. Conversely, there may be determined the least difference in the universe consistent with that observed on the basis of this or a similar rule. It should be noted that the use of this rule should be limited to cases where sample size (number of observations) is 100 or more.

The hypothesis that the difference for the universe is zero requires that P and P' be equal, or $P-P'=0$. Substituting this in (4), it remains necessary to estimate $P+P'$, and for this there may be taken the corresponding value observed in the sample, or $p+p'$. Prof. Brown, however, takes p and p' throughout as estimates of P and P' respectively, giving a somewhat smaller value of σ_d than corresponds to the hypothesis of a zero difference.

The application may be illustrated by solving the problem given as Problem 3 in Prof. Brown's paper. In this there are given the votes of 1168 housewives expressing a preference for one of four stores. The data are given by Prof. Brown as follows:

Store	*Votes*	*Per Cent*
Kirkland	671	57.5
Parker	311	26.6
Freeman	138	11.8
Manning	48	4.1
	1168	100.0

To determine whether the difference between Kirkland and Parker is significant, the observed difference (30.9 per cent) is compared with three times the standard deviation expressed as a percentage, or $300\sigma_d/N$ on the assumption of a zero difference in the universe (i.e. $P-P'=0$). As an estimate of $P+P'$ there is taken the combined vote

for the two stores expressed as a fraction, or $0.575+0.266=0.841$. This gives a value for $300\sigma_d/N$ of 8.05 per cent, which is much less than 30.9 per cent, the observed difference. It is concluded that the difference is significant. Similarly in examining the difference between Freeman and Manning, $P+P'$ is taken as $0.118+0.041=0.159$, giving a value for $300\sigma_d/N$ of 3.50 per cent, which is again less than the observed difference, 7.7 per cent. Hence the difference between Freeman and Manning is also significant. These conclusions agree with those obtained by Prof. Brown, although his values of σ_d are, as explained above, somewhat smaller than those given here.

The illustration may be extended to cover a case such as might arise in practice in which it is desired not only to establish the existence of a difference, but to place some limit to its value. In the problem considered above, for example, it might be necessary to determine if the difference in percentage vote between Kirkland and Parker is significantly greater than 20 per cent. In this case, σ_d is obtained from (4) with $P+P'$ taken as 0.841 as before, and $P-P'$ taken as 0.20. This gives $300\sigma_d/N$ as 7.86 per cent so that the difference is significantly greater than 20 per cent if it is greater than 27.86 per cent. As the observed difference is 30.9 per cent this condition also is satisfied.

METHODS IN WILDLIFE CENSUSES*

Most forms of wildlife are so elusive, so really wild, and have so many hiding places, that the obtaining of anywhere near an accurate estimate of their numbers on any extensive area has proven exceedingly difficult. In fact, known methods have been so unsatisfactory that the Biological Survey has now detailed a research worker to the major problem of studying methods of taking censuses of wildlife. These difficulties of observation apply particularly to the mammals, many species of which den in hollow trees, among rocks, or in holes in the ground from which they are difficult to expose. Many of the larger species inhabit dense forests and are so wary that unless special means are employed they are rarely seen. So complicated is the taking of mammal censuses and so varying the habits of the different species that it is necessary to employ a different method for almost every group.

For several years the Biological Survey has conducted investigations in various parts of the country on beavers, as a part of which methods of determining beaver populations on a given tributary stream, slough, lake or large river have received attention. While no method yet devised is entirely dependable or infallible, yet several seem practicable and to offer possibilities. The old method of estimating by counting houses and bank burrows, and arbitrarily allowing five beavers to each domicile, tended towards overestimation. The error lies in that occasional single old male beavers leave the original colony and occupy quarters that would indicate the presence of a new colony, and young breeding pairs in establishing new colonies may not rear young until the following spring. In making censuses of beavers very important considerations are the temporary occupancy of houses and bank burrows, the interference by poaching or legal trapping, the effect of recent floods on destruction of beaver dams and on migration, and the distance from the home dam to available food supply.

Two methods of taking beaver censuses which have promise involve considerable detail but approach the desired accuracy. One of these, the use of live traps for the purpose of trapping to completion the individuals living in what appears to be one active colony, seems to be more accurate and dependable. The tagging or tail-marking as the animals are released prevents duplicating the count. Six traps under favorable conditions exhaust the colony in a few nights' trapping. Using a known number of active dams, houses, and bank burrows, and a given length of stream, and the trapped numeration from representative colonies, the enumerator can obtain a fairly accurate estimate for an entire watershed.

The other method can be used to advantage in restricted watersheds, where footprints show frequently in soft earth along stream banks, and

* Prepared under the direction of W. B. Bell, Chief of the Division of Wildlife Research, Bureau of Biological Survey, United States Department of Agriculture.

sandy bars, where preliminary work on measuring the beaver's right hind footprint in millimeters affords a new census method. Several hundred measurements within an active colony shows by length variation the different individuals living there.

On certain lakes, sloughs, and large rivers, the most practicable way of estimating numbers of beavers is to observe their activities at dusk from favorable vantage points. Late in summer and in fall, beavers are very active, and it is possible to count an entire colony at one time. Several evenings' observations give a fairly accurate estimate of the colony.

Live-trapping to exhaustion and marking all individuals so as to keep accurate tab of individuals, as recommended for beavers, is also adaptable to many small mammals, such as, for example, mice and shrews. It is often desirable to know the density of population of these inconspicuous animals in order to correlate their numbers with their economic importance, whether it be on the credit or debit side of the ledger. In the case of these small mammals, where the census area is usually comparatively small, marking of individuals is ordinarily accomplished by clipping off certain toes, which does the animal little harm and makes possible a surprisingly large number of combinations for markings.

Population estimates can be made quite accurately and very easily on certain species that build conspicuous nests, mounds, or shelters. The banner-tailed kangaroo rats of our Southwestern deserts make their dens by throwing up mounds of soil that range from 6 inches to 4 feet high and from 5 to 15 feet in diameter. Careful habit studies of this species have shown that only a single animal inhabits a mound except when young are present. A count of the mounds on a known area thus gives the number of kangaroo rats on the area. By this method 50 square miles of a Range Reserve was estimated to have a population of 64,000 kangaroo rats. It was further estimated that since each rat stored on the average of 4 lbs. of grass seeds and crowns and other forage annually, a total of 128 tons of edible forage was rendered unavailable for stock on this range.

Taking censuses of some of the so-called fur-bearers is important, but is often difficult and tedious on account of the general seclusion of these mammals. The most satisfactory results have been obtained by locating all the dens on a known acreage or square mileage, and then measuring in millimeters at each den the right hind footprints under favorable conditions of soft soil or snow to show tracks. This method usually tells not only the number of animals inhabiting the den, but often whether an adult male and female are present, and the number of young. It is particularly useful for such mammals as skunks, minks, badgers, otters, and foxes.

Jack rabbits live in open country and it has been possible to count them over a strip 500 feet wide from an automobile moving at 10 to 15 miles per hour. Several such counts in one region covered a lineal distance of 238.4 miles, the area covered was approximately 14,448 acres, on which 767 rabbits were recorded, or 0.053 per acre. Number of pellets on an area is in

proportion to number of rabbits, and, while they give no absolute numbers, pellet counts are a reliable method of determining relative abundance of rabbits.

The counting of big game animals is somewhat expensive since it involves either the use of airplanes for counting from the air, or the employment of a considerable number of men for drives. Either of these methods when properly conducted, however, gives a fairly accurate estimate, but each must be employed under different conditions, the airplane for plains, open brushland, and winter deciduous woodland, whereas the drive is most efficient under cover of woodland, if not too dense.

Thus one can understand that the use of airplane would be more successful with such species as pronghorn antelope, bighorn sheep, mountain goat, buffalo, and under favorable conditions, particularly in winter, with deer, elk, and caribou. William H. Marshall, specializing on census methods for the Bureau, designates certain general points to be considered in using an airplane for census purposes:

1. Slow planes are desirable. Those with speeds higher than 90 miles per hour carry the observer over the territory too rapidly.

2. Low altitudes are essential. At 500 feet or less, one can see all the animals if the cover is not too dense and they are not too protectively colored. At 100 feet most of the animals start to move so that they may be seen readily, but this may be a disadvantage when there are large numbers since they mill around, the separate groups are lost sight of, and duplications in count are likely.

3. More than two observers are undesirable, because of possibilities of duplications.

4. A knowledge of the topography and plant cover of the country to be covered is essential.

5. The pilot should be informed in advance, insofar as possible, exactly what area is to be covered and how.

6. The observer should have had field experience with the animals to be censused.

7. Clear, still weather is desirable.

As an example of a detailed big game count made chiefly by airplane may be cited the following tabulation of the census of elk in the Jackson Hole region, Wyoming, made in the Spring of 1935:

Vicinity of Jackson, North of Jackson	452
Black Tail Butte	56
Buffalo River and Spread Creek	331
Sheep Mountain	388
River bottom, west of River, south of Wilson	104
River bottom, east of River, south of Jackson	117
Foothills, south of Jackson, to Horse Creek	264
Leeks Canyon	45
Game Creek	115
Squaw Creek	43

Porcupine Creek	254
Horse Creeks, not on feed ground	35
Hoback River, mouth to canyon	458
Hoback Canyon, to Van Vleck Ranch	188
Granite Creek, to Swift Creek	18
Cliff Creek and Sandy Marshall Draw	79
Fisherman Creek	3
Mount of Hoback, to Bailey Creek, East of Snake River	443
Bailey Creek to Bailey Lake	82
Willow Creek, to Hunter Creek	494
Alder Creek	7
Cabin Creek and Dog Creek	351
Canyon of Snake River, West side from Munger Mountain to Bailey Creek	290
Munger Mountain	496
Fall Creek and Coburn Creek	213
Gros Ventre	6,079
On Feed Grounds	10,630
Grand totals	22,035

All feed grounds were counted afoot, all other areas by plane.

Members of the Biological Survey, State Game Department and Forest Service took the census.

Airplane census made by F. Buchenroth, O. A. Pendergraft, Fred Deyo and Leo Laythe.

The report was signed by: A. C. McCain, Forest Supervisor; F. Buchenroth, Principal Forest Ranger; Almer P. Nelson, U. S. Game Management Agent, Biological Survey; and by Fred H. Deyo and O. A. Pendergraft, Assistant State Game and Fish Commissioners.

In making a "deer drive" count, among the first steps is to have a plant-cover type survey of the entire refuge or area, with known acres of each type. Representative plots of between 200 and 350 acres, and preferably triangular in shape, are selected from the various cover or game types for the counts, and after these are made the results can be apportioned to the total acreage and a fairly accurate estimate made of the number of deer on the refuge.

As many as 150 to 200 men are necessary for a deer drive, and the success of the drive depends a great deal upon the placing of these men and the care with which they operate. Men (watchers) are quietly placed according to visibility along two sides of the triangle. The drivers some 30 or 40 feet apart form a line in good formation on the third side of the triangle, and advance coming closer and closer together as they approach the apex of the triangle. Each man, watcher or driver, counts each game individual that passes him to the right and between him and the next man. If an animal returns within the triangle it is also counted as "in," so that the net count shows only animals originally within the area and actually driven from it.

In estimating bird populations and concentrations there are several

methods that have been successfully used by the biologists and cooperators of the Biological Survey.

In the case of colonial nesting birds the method is obviously one of much simplicity since it is only necessary to count tle occupied nests and (since very few of such birds are polygamous) multiply by two. This obviously does not take into consideration the nonbreeding birds that may be present in the colony but for most species the numbers of nonbreeders that will frequent a nesting colony is relatively few.

In the spring of 1914 the Survey started an inquiry for the purpose of determining the number, distribution and relative abundance of the breeding birds of the United States. This investigation was confined almost exclusively to the nongame species, chiefly the passerine birds. The actual work was done mainly by volunteer cooperators. While sometimes, because of local conditions, it was desirable to have a count made over a large area, ordinarily it was found desirable to keep the areas surveyed within a tract of not more than 80 acres. On an area of this size one observer could during the nesting season actually count the birds with considerable exactness. The method followed was to count the singing males during the height of the nesting season, it being assumed that every singing male represented a pair of birds. The ecological type of the area surveyed is, of course, an important part of the report, as such areas were intended merely as samples.

In work with migratory waterfowl two methods have been used with considerable success, one based entirely upon visual observation and the ability of the observer to accurately estimate distances, while the other involves a mathematical computation based on the relation that appears to exist between the number of ducks banded and the number of those killed during the first succeeding hunting season.

The first of these two methods was worked out in 1922 under exceptionally favorable conditions at Crane Lake, Illinois. The birds involved in the original study were almost entirely mallards. Briefly, this method consists of estimating in square yards the area that may be covered by a concentration of ducks, allowing one duck per square yard and then to allow for the raft end taperings and open spaces within the formation to subtract one-third from the figure obtained. Obviously, the success of this method depends entirely upon the ability of the observer to estimate the length and breadth of the formation. It has, however, been checked on two different occasions through the application of aerial photography, once on mallards and once on canvasbacks. In both instances the results tallied so well with the original estimate as to demonstrate the reliability of the method for all practical purposes.

The second method is, of course, purely a matter for office technique. In May 1930, the Bureau published as Circular No. 118 the results of the study that was then possible. It should be borne in mind that the data then used were based upon the continuous open seasons of 90 days that had preceded this period. At that time it was found that the first year recovery percentage

was between 11 and 13 per cent and on this figure it was postulated that if we might obtain a reliable estimate of the total number of ducks killed in any one shooting season it would, by a simple mathematical formula, be possible to estimate the waterfowl population for that season. Since that time we have had shooting seasons of at least two types and of different lengths which obviously has a disturbing effect upon the figures and it also appears that there are other factors which must be brought into the picture.

In the midwinter inventory work that has been conducted for the past three years the first of these methods, namely the estimate of raft concentrations, has been chiefly the one employed.

Perhaps the most common method that has been in use by Biological Survey employees and cooperators is that of estimating the units of a flock, or units of birds on the water, and computing the total number in a flock on that basis. This is an old method and it has been and still is being used by a great percentage of the people who have been making bird counts for the Bureau. With the flock in motion, it is absolutely impossible for the majority of people to make area estimates and compute birds, on that basis. One, however, can divide off units and count those birds in the units, and then compute the total.

PROGRESS OF WORK IN THE CENSUS BUREAU

BEGINNING PREPARATIONS FOR THE SIXTEENTH CENSUS

Under the existing law, and in the absence of any new legislation changing the date, the next decennial census will be taken as of April 1, 1940. Realizing that it is none too soon to begin preparing for this undertaking, the Bureau of the Census has obtained a small appropriation to be used for that purpose during the current fiscal year. One of the first things to be done is to establish enumeration districts covering the entire inhabited areas of the United States. For this purpose and also for the guidance of enumerators and supervisors when engaged in taking the census, maps are needed showing political divisions, streams, railways, roads, etc., on a scale of about one inch to the mile. For a large part of the United States adequate maps are lacking. Government surveys cover adequately only about 26 per cent of the total area. Thus far the Bureau has obtained maps covering about 1,200 of the 3,091 counties in the United States. There were 120,003 enumeration districts in the last census and, of course, with the growth of the population, there will be many more in 1940.

A list of institutions is being prepared in order that each institution may be assigned to the proper enumeration district or made a separate district in itself as conditions may require. There are about 30,000 institutions.

A CLASSIFICATION OF WORKERS BY SOCIAL-ECONOMIC STATUS

In the reports of the Census Bureau the gainful workers enumerated in the population census are regularly classified by their occupation or the kind of work in which they are engaged; and occupations are distributed under a few main divisions of the industrial field, such as agriculture, manufactures and mechanical industries, trade, etc. The census of 1930 included also a classification by industries, in which the criterion is not the kind of work done, but the industry in which the worker is employed. There is a considerable demand and use for still another grouping based not on what the worker does nor on the industry in which he works, but on his social-economic status as indicated by his occupation. Certain studies, prepared in the Census Bureau, have already been published giving a grouping of that character; and the Bureau is now preparing a report showing this grouping for the workers classified by industries or services. It distinguishes six main groups as follows: Professional persons; proprietors, managers and officials; clerks and kindred workers; skilled workers and foremen; semi-skilled workers; unskilled workers. There is a subdivision of some of these groups. The group of unskilled workers distinguishes farm laborers, factory and building construction laborers, other laborers, and servant classes; and the group of proprietors, etc., distinguishes farmers, wholesale and retail dealers, and other proprietors. These social-economic groups will be shown for each of the 128 industries or services distinguished in the industrial classification of gainful workers; and the members of each group within the industry or

service will be distributed by color, nativity, sex, and age. The report gives only totals for the United States. But in the meantime the National Resources Committee has prepared a report classifying by the same social-economic groups the gainful workers in each state and each city of over 500,000 inhabitants with a further classification by color, nativity, and sex, but not by age nor by industry or service.

The material for the Bureau's report has gone to the printer and will be printed in type making a volume of about 250 octavo pages.

JUDICIAL CRIMINAL STATISTICS

The report on judicial criminal statistics for 1935, now in the hands of the printer, will be the fourth annual report in that series since the Bureau, under an Act of Congress passed in 1931, began collecting these statistics.

The basic data are derived from the records of the courts of general criminal jurisdiction in the several states. These are the courts which have the power to try and dispose of felony cases. Unfortunately for statistical purposes, there are wide variations in their jurisdiction, which in some states is limited mostly to major offenses while in others it may include such misdemeanors as disorderly conduct and violations of driving and parking laws.

This lack of uniformity interferes seriously with the comparability of the statistics by states. For instance, the fact that in 1934 the percentage of convictions resulting in a prison sentence ranged from 5.8 per cent in Wisconsin to 69.4 in Colorado is mainly accounted for by the fact that in one state 74.4 per cent of the cases reported by the courts were minor offenses, while in the other state the corresponding percentage was only 23.4. To meet this situation the comparative analysis by states in the 1935 report will be based on that portion of the cases reported which have been classed as "major offenses," although data for all other offenses will be given in other connections.

The data for this inquiry are supplied on tally sheets which are filled out by the court clerks as one of their regular duties. They work under the supervision of some state official who examines and approves their returns. This method of obtaining the data is inexpensive, but in other respects is not altogether satisfactory. It has been found that much of the detail called for is not being accurately reported by the court clerks, and it may prove necessary to simplify further the tally sheets. It is planned to do some experimental work in individual case reporting. But to adopt that method would probably require an increased appropriation, which it is not easy to get in these days.

The work at present covers 31 states. This includes all the Northern and Western states, except Missouri, and Nevada.

A CENSUS OF PUERTO RICO

A census of Puerto Rico covering population and agriculture was taken as of December 1, 1935, under the auspices of the Puerto Rico Reconstruction

Administration. The tabulation of the data and the preparation of the reports were under the immediate direction of the Chief Statistician for Population in the Bureau of the Census.

Three bulletins, with text in English and in Spanish, will be issued. The first bulletin, presenting statistics of population for the island as a whole and for each municipality, barrio, city and town, for 1935 and 1930, with certain comparative figures for earlier censuses, was published December 3, 1936. The other two bulletins will be issued early in the fall, one giving the composition and characteristics of the population, including data on families, occupations, and unemployment, and the other, detailed statistics of agriculture.

AN ADVISORY COMMITTEE ON FINANCIAL STATISTICS OF CITIES

A special advisory committee for the Division of Financial Statistics of Cities has been established comprising the following members appointed by the Secretary of Commerce: Frederick L. Bird, Municipal Service Department, Dun and Bradstreet, Inc., New York City; Welles A. Gray, United States Chamber of Commerce, Washington, D. C.; A. M. Hillhouse, National Committee on Municipal Accounting, Chicago; Dan O. Hoye, City Controller, Los Angeles; and Charles J. Fox, City Auditor, Boston.

The first meeting of the Committee, held in Washington last June, was devoted mainly to a survey of the work of the division. The committee, however, went on record as urging strongly the renewal of the collection of financial statistics of states, which was discontinued in 1932.

J. A. H.

STATISTICAL NEWS AND NOTES

CENTRAL STATISTICAL BOARD.—A book of charts of time series, selected on account of their significance for economic stabilization, is under preparation for the National Resources Committee by members of the staff of the Central Statistical Board. The book will contain some 200 charted series reflecting cyclical fluctuations in important phases of business activity and related changes in other aspects of our society.

Each page of charts will be accompanied by a page of text material discussing, first, the significance of the charted series; secondly, the principal virtues and defects of the series in comparison with other available data; and thirdly, objective specifications for each series. It is intended by careful selection to provide a broad picture with a limited number of series. The chartbook should be of service not only to Government agencies but also to students of economic and social conditions outside of the Government, and should fill an important need. It is hoped that the book will be available in October.

DOMINION BUREAU OF STATISTICS, CANADA.—*1936 Census of the Prairie Provinces.* The final tables for the volume on population of the three Prairie Provinces are well under way. The compilation of the agricultural census is almost completed. Unemployment, employment and earnings tabulations for cities of 10,000 population and over are compiled and preliminary figures are available. Final tables are expected to be started before the end of this month.

The monograph on "The Rural and Urban Composition of the Canadian Population" has reached an advanced stage in preparation and it is expected it will be ready for publication in the near future.

Social Analysis Branch. At the Conference on International Relations (Carnegie Endowment), which was held at Queen's University, Kingston, June 14 to 18, 1937, three papers were read by members of the staff of the Bureau of Statistics. Dr. R. H. Coats gave the paper entitled "Movements of Population between Canada and the United States." The Chief of the Social Analysis Branch read the paper on "United States Born in the Professions in Canada," and the Chief of the Internal Trade Branch delivered the paper entitled "Movements of Capital and Balance of Payments."

Manufactures Branch. This Branch is at present compiling statistics of weekly wage payments to wage-earners in the manufacturing industries of Canada. This is a new development and the report is expected to be published in the autumn. It will contain such wage payments by sex and wage groups analyzed by industries, provinces, cities, and towns.

Certain difficulties have been encountered in applying the ruling that net value of production should be computed by subtracting the cost of materials and also the cost of fuel and electricity from the gross value of products. The Forestry Branch reports that in connection with the pulp and paper, lumber

and wood-using industries a large proportion of their fuel consists of wood wastes which has already been purchased as part of their raw material and that its use as a fuel should not be subtracted a second time from the gross production when so used. The policy has been adopted of adding the value of such wood waste used as fuel to the gross production. This results in treating this wood waste as a fuel sold by the reporting firm to itself. The same procedure is adopted in the petroleum industry where petroleum produced by an individual firm and used as a fuel in their plant is added to their gross production.

Education Statistics Branch. The Bureau of Statistics, through the Education Statistics Branch, was represented at the Canadian Universities Conference held May 31 to June 1, 1937, at Queen's University, Kingston, Ontario. The Conference instructed its Executive to appoint a committee to study university statistics during the coming year as the foundation of future policy.

Finance Statistics Branch. The Hon. W. D. Euler, Minister of Trade and Commerce, has called a Conference at Ottawa, which will open on July 19, to discuss the subject of municipal statistics. Representative delegates from the Departments of Municipal Affairs of each province, as well as representatives of the City Treasury Departments of the larger cities in each province, will meet with representatives of the Dominion Bureau of Statistics and formulate plans to bring about coordination and publication of uniform municipal statistics throughout Canada.

BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM.—The Board of Governors of the Federal Reserve System has revised its monthly index of freight-car loadings. The revised series, like that formerly published, is based on the weekly figures of the Association of American Railroads and is compiled both with and without adjustment for seasonal variation. The total index is derived by weighting indexes for the various classes of commodities on the basis of revenue obtained from each class rather than by adding the actual number of carloads as was done in the previous index. The purpose of this change is to allow for differences among commodity classes in the importance of the average carload. The revised index is described on pages 522 and 523 of the *Federal Reserve Bulletin* for June 1937.

Statistics on loans at weekly reporting member banks in 101 leading cities are now published in the *Federal Reserve Bulletin* for the more complete loan classifications that became effective May 19, with the new items also grouped to give figures closely comparable with data previously reported. A detailed comparison of the old and new loan classifications was given on pages 530–531 of the June issue of that *Bulletin*.

The twenty-third Annual Report of the Board of Governors of the Federal Reserve System, which was issued in June, contains a discussion of outstanding credit and business developments, reports of the operations of the Federal Reserve System, and records of policy actions of the Board of Governors and of the Federal Open Market Committee in the year 1936.

The most important recent development for the Federal Reserve System was the increase in reserve requirements of member banks made by the Board of Governors in 1936 and the early part of 1937. Reasons for this action are fully discussed in the report, and there is also given a brief statement of the history and purpose of reserve requirements. The large gold and international capital movements in recent years, which have caused a rapid increase in member bank reserves, are described and analyzed in the report. Other sections deal with the continued growth of bank credit and deposits, developments in security markets, including the Board's actions with regard to margin requirements on security loans, and the further recovery of business.

The complete edition of the Annual Report, containing statistical tables and other detailed information relative to the Federal Reserve System, was issued later in the summer.

SECURITIES AND EXCHANGE COMMISSION.—During its third fiscal year, ended June 30, 1937, the Securities and Exchange Comission has continued to expand the scope of its statistical activities. Again only a small part of the material collected has been released for publication. The more important statistical data released during the year ended June 30, 1937, (for statistics released before that date see this JOURNAL, September, 1935, pages 608–609; September, 1936, page 578) included:

(1) Figures on purchases and sales of certain groups of members of the New York Stock Exchange and New York Curb Exchange have been released weekly on a daily basis since March, 1936, and are published about one month after the transactions occur. Comparable data for the period from June 27 to December 18, 1935, were contained in the Commission's Report on the "Feasibility and Advisability of the Complete Segregation of the Functions of Broker and Dealer." A summary of the weekly releases through March, 1937, with corrections as received from the exchanges, was made available in the Public Reference Rooms of the Commission's Washington office and of its principal regional offices. Thus, there is now available a continuous daily record of members' trading on the New York Stock Exchange and the New York Curb Exchange since March, 1936.

(2) In June, 1937, the Commission commenced to make available daily at the Washington office figures showing for the second day preceding that of the release, the number of shares purchased and the number of shares sold in odd-lots by odd-lot dealers and specialists on the New York Stock Exchange, together with the number of orders involved in such trades. These figures are reprinted in the financial pages of many daily papers. Weekly summaries of these figures, as corrected by more complete reports from the odd-lot dealers, and expanded to include the value of daily purchases and sales in odd-lots, are made available to the public in release form.

(3) The comprehensive statistical data on investment trusts and investment companies collected in connection with the Commission's study, authorized by the Public Utility Act of 1935, have been prepared for pub-

lication, at least in part, in the Commission's forthcoming report to Congress. Combined balance sheets, income accounts, and security portfolios of groups and sub-groups of investment trusts and investment companies constitute the most voluminous part of the statistical compilation.

DIVISION OF RESEARCH AND STATISTICS, FEDERAL DEPOSIT INSURANCE CORPORATION.—The Annual Report of the Federal Deposit Insurance Corporation for the year ending December 31, 1936, has been issued. The report follows the style and form of previous reports and shows that the Corporation met promptly all insurance claims presented to it by depositors in 75 insured banks placed in receivership from the beginning of deposit insurance to the close of 1936 (pages 8–9), and made loans to facilitate mergers and reduce loss to the Corporation in the case of 28 insolvent insured banks (pages 9–12). The Corporation has met all losses and paid all expenses out of income from investments and has transferred to surplus all assessments received (pages 34–37).

More than 140 weak or insolvent insured banks were eliminated during 1936 through suspensions, mergers, liquidations or reorganizations (pages 8–12). Up to the close of 1936 the Corporation cited 24 banks for unsafe and unsound practices, specifying more than 50 such practices in which the banks had engaged (pages 16–19).

More than one-tenth of the insured banks, holding more than one-fourth of the deposits of insured banks, had less capital than the Corporation deems essential (pages 27–28, 51–55). Of the banks authorized to establish branches during 1936, one-third, holding more than $3 billion of deposits, had insufficient capital (pages 25–26).

Earnings of banks improved substantially during 1936 (pages 55–57). On the average the small banks reported higher net earnings on each $100 of total assets than did the large banks (pages 58, 172–73). The small banks, furthermore, show a higher ratio of sound capital to deposits than do the large banks (pages 52–53).

Deposit insurance and the banking system have not yet been tested sufficiently to justify a reduction in the rate of assessment (pages 34–38).

The report contains considerable statistical information not heretofore available for presentation, regarding the number and deposits of operating insured and noninsured commercial banks, grouped according to type of banking office; by size of bank, as measured by amount of deposits; by population of center in which located; and by number of commercial banking offices in same center. The reports for the year 1936 of earnings, expenses, and disposition of profits of insured commercial banks not members of the Federal Reserve System are presented as tabulated on the basis of size of bank; number of banking offices in and population of center in which located; profitability of operations; and types of assets and liabilities.

A report on deposits of insured banks as of May 13, 1936, based upon a special survey made by the Corporation, is also presented.

BUREAU OF FOREIGN AND DOMESTIC COMMERCE.—An analysis of world production and trade in leather footwear was issued by the Bureau in July. This publication is prepared as a service to the boot and shoe industry and presents a series of data for both leather and rubber footwear, of value to those groups. Statistical data is shown covering the production, consumption, imports, and exports for the nations of the world. The subject of artificial trade barriers, such as quotas, compensatory imports, exchange restrictions, exchange fluctuations and British Empire preferences, is discussed with particular reference to the effect of these barriers on the leather footwear industry.

The Marketing Research Division of the Bureau is publishing by states a list of state and local trade associations. These lists, in addition to showing the names and addresses of each association classified by cities in which they are located, present pertinent data from the 1935 census for that state. Free copies of these lists can be obtained from the District Offices of the Bureau located in the principal cities throughout the United States or directly from the Marketing Research Division in Washington.

Due to the considerable amount of attention being devoted to the subject, this Division has also issued a bibliography of publications on consumer cooperatives. This bibliography is representative of the best material available on this subject. All *Journal* readers interested in obtaining a copy of this bibliography may secure it by writing the Marketing Research Division of the Bureau of Foreign and Domestic Commerce, Washington.

The Bureau's study of "Consumers Use of Selected Goods and Services by Income Classes" has been expanded to include data from approximately 230,000 families located in 50 cities which are well distributed, geographically, throughout the United States. This study is based on individual family income reports for 1933 and the family's use, during 1934, of such products as building materials, househeating apparatus, mechanical refrigerators, installed bathing facilities, fuels for lighting, heating, and cooking, automobiles, and so on; and, the facts given apply to innumerable related products such as ice refrigerators, ranges, electrical appliances, and paints. To date reports are available for 34 cities, and the next report, which will be issued in the fall, will cover the remaining cities. Copies of the reports as well as a list of the cities covered can be secured from the Bureau or any of its offices.

A report giving statistical data, on a county basis, for each of the major groups in the pulp and paper industry, both by types of product and by manufacturing machinery in place, has recently been issued. The report is the fourth in the Bureau's series covering basic industrial markets of the United States. Those previously published cover Textiles, Iron and Steel, and Gas and Electric Utilities Industries. The present volume contains 77 pages of text and tables with 12 accompanying maps.

Another Bureau study of interest is a complete survey of the "Effects of City Water and Sewerage Facilities on the Market for Air Conditioning Equipment in Cities of 100,000 Population and Over." This is the first time

that data on the water supply facilities of major cities has been gathered. The report shows the source of city water supply, the amount of reserve water upon which the city may draw, the amount actually used over a 6-year period, the additional services that may be had with the present equipment, together with other basic information, all of which has a direct effect upon the value of each of these cities as a potential market for air-conditioning equipment.

A series of maps of the United States, based upon 1935 retail trade data, has been appearing in *Domestic Commerce*. These maps are designed to show retail sales, per capita sales, concentration of retail stores by types of enterprise, marketing centers, rural sales, and market distances. These maps will be reprinted and distributed by the Marketing Research Division.

In July the Specialties Division published an analysis of "Japanese Production of Glass and Glass Products" and their exports of such items. A similar study for all of the Latin-American countries will be issued in the early fall. Both studies discuss the possible future development of trade in this commodity.

For the first time a comprehensive study of the foreign graphic arts industries is being made by the Bureau. This study, in addition to discussing the major branches of graphic arts in about 70 countries of the world, will point out the potential markets for products of the graphic arts and for equipment, supplies, and machinery used in their production.

BUREAU OF AGRICULTURAL ECONOMICS.—Last year Dr. A. G. Black, Chief of the Bureau of Agricultural Economics, set up a Bureau Statistical Committee to examine the statistical work of the Bureau and make recommendations for its improvement. After obtaining information from the various divisions regarding statistical series compiled by the Bureau, subcommittees were established to review the data relating to various phases of the Bureau's work. The study of the subcommittees' reports is now in progress. Some of the recommendations of the committees have been approved by Dr. Black and have been transmitted to division leaders in a series of statistical memoranda, of which six already have been issued. One of these provides for concentration of responsibility for acreage, yield, and production estimates of domestic crops. Others call for the elimination of annual farm income estimates on a crop year basis, the approval before issuance of new statistical series by the Chief of the Bureau upon recommendation of the Bureau Statistical Committee, the clearance of proposed questionnaires through a Questionnaire Clearance Committee, and more careful examination before publication of statistical series not originating within the Bureau. In general, the amount of duplication in the compilation of statistical series was found to be smaller than might have been expected in an organization of this size, handling upwards of a million separate statistical series, but many opportunities for improving the reliability and adequacy of Bureau statistics seem to be present.

In the June 1937 issue of the "Agricultural Situation" Dr. Mordecai Ezekiel published a brief summary of an estimate of savings by individual income taxpayers which was recently prepared, together with a discussion of the apparent relation betwen these personal and corporate savings and the production of durable and non-durable goods. This preliminary examination is held by the author to support in general the oversavings theory of business depressions. It is expected that the details of the preparation of Dr. Ezekiel's estimates of savings will shortly be published in one of the professional economic journals.

Secretary Wallace has appointed a committee for the Department of Agriculture to consult with the Census Bureau with respect to the United States Census of Agriculture for 1940, as has been customary in connection with past decennial enumerations. The committee has received recommendations from the various bureaus of the Department, and after editing designed to eliminate duplications and reduce the number of questions, has transmitted them to the Bureau of the Census. The Agriculture Committee of the Bureau has held joint meetings with the Department committee for the purpose of ironing out difficulties preliminary to the preparation of a trial working schedule which will be given field tests before the final schedules are prepared.

U. S. BUREAU OF MINES.—The canvass of the mineral industries for 1935 was a cooperative effort under which the Bureau of Mines collected the information utilizing funds supplied by the Census of Business. In addition to the usual items elected by the Bureau of Mines, the canvass included questions covering the Census inquiries on value of product, expenditures for supplies and materials, fuel, and purchased electric current, and the number and compensation of both wage earners and salaried employees. Other information obtained included wage earners employed by months. Preliminary figures for all important mineral commodities have been issued in mimeographed form by the Philadelphia office of the Census of Business. Final figures including detailed state tables on bituminous and anthracite coal will be released in booklet form by the National Research Project on Reemployment Opportunities and Recent Changes in Industrial Techniques of the Works Progress Administration. A second booklet summarizing important employment and related data for petroleum, metals, and nonmetals (excluding fuels) is in preparation.

Studies entitled, "Technology and the Mineral Industries," by F. G. Tryon, T. T. Reed, K. C. Heald, G. S. Rice and Oliver Bowles, and "Small-scale Placer Mines as a Source of Gold, Employment and Livelihood in 1935," by C. W. Merrill, Chas. W. Henderson and O. E. Kiessling, have been released in May and June. These reports were made possible by a cooperative arrangement between the Bureau of Mines and the Works Progress Administration's National Research Project. The cooperative arrangement provides for a series of studies on relationships between changes in mineral

technology and output per man. O. E. Kiessling, Chief Economist of the Mineral Production and Economics Division of the Bureau of Mines, is in charge of these joint studies; F. G. Tryon, Chief Economist of the Bureau's Coal Economics Division, is supervising the work on the coal industries as well as consulting on other phases of the analysis.

BUREAU OF RESEARCH AND STATISTICS, SOCIAL SECURITY BOARD.—Administrative organization of this Bureau follows the main functional lines delegated to the Social Security Board under the Social Security Act. Ewan Clague is Acting Director, succeeding Walton H. Hamilton, who has been named Special Economic Consultant to the Social Security Board and to the Bureau. Thomas C. Blaisdell, Jr., is Assistant Director. The Administrative organization comprises: Division of Public Assistance Statistics, Helen R. Jeter, Chief; Division of Public Assistance Research, Chief to be appointed; Division of Unemployment Compensation Statistics, William McCaw, Acting Chief (on temporary assignment to the Bureau of Unemployment Compensation), Robin Hood, temporarily in charge; Division of Unemployment Compensation Research, Louis Bloch, Chief (on temporary assignment to the Maritime Commission), Collis Stocking, Acting Chief; Division of Federal Old-Age Benefits Studies, Eleanor L. Dulles, Acting Chief; Division of Health Studies, I. S. Falk, Chief; Service (Administrative) Division, Ernest R. Burton, Executive Officer, Chief; Division of Economic Studies, Chief to be appointed. Activities of the divisions are to be coordinated by three assistant directors. Mr. Blaisdell is charged with this responsibility for the Divisions of Public Assistance Research and Statistics and the Division of Economic Studies. At the present time Mr. Clague is acting in this capacity for the Divisions of Unemployment Compensation Research and Statistics, and Mr. Falk for the Division of Federal Old-Age Benefits Studies and Health Studies.

A multigraphed monthly bulletin, *Selected Current Statistics*, is prepared by a committee of the Bureau staff to report data on current operations under the Act and certain basic economic data in the field of social security. Preparation of the sections of this bulletin is the responsibility of the respective divisions concerned with the subject matter. Intended primarily for use by the staff of the Board, this bulletin is now available to state administrative organizations in the field of social security, and in some cases to other individuals concerned with the subject.

Among current activities of the divisions are the following:

Division of Public Assistance Statistics. A note in the March issue of this JOURNAL outlined the organization of this Division and the general scope of its activity. On April 1, as detailed below, this Division assumed complete responsibility for the collection of general relief statistics, while reports on relief in rural areas will be received by the Division beginning with those for July. In the April issue of the bulletin, *Public Assistance, Monthly Statistics for the United States*, the Division started regular reporting of total public

relief, comprising general relief, public assistance, wages under the Works Program, and payments under other major public programs.

Statistics of Public Assistance under the Social Security Act: Monthly statistics on old-age assistance, aid to dependent children, and aid to the blind are reported to the Social Security Board by cooperating state agencies. These data are published in monthly and quarterly bulletins and in two mimeographed releases. Data for April 1937 and estimates for May and June appeared in a mimeographed release on June 1. *Public Assistance, Monthly Statistics for the United States*, containing data for April, was published on June 14.

General Relief Statistics: Upon the advice of the joint Advisory Committee on Relief Statistics of the Works Progress Administration and the Social Security Board, the entire responsibility for the collection of relief statistics was transferred to the Social Security Board as of April 1, 1937. Complete data for 26 states and partial data for 14 states were published in the April bulletin which was released on June 14. Data for January, February, and March will be published jointly by the Social Security Board and the Works Progress Administration in the monthly bulletin entitled *General Relief Statistics*.

Relief in Urban Areas: The series of relief statistics from public and private agencies in 116 urban areas, formerly published in the United States Children's Bureau and transferred to the Social Security Board on July 1, 1936, is continued in a new monthly publication of the Social Security Board entitled *Relief in Urban Areas*. The first number covering data for January 1937 was published on May 15; the second, containing data for February, was published on June 8.

Relief in Rural Areas: Progress has been made toward the transfer of the series on relief in rural areas and small towns from the Works Progress Administration to the Social Security Board. Through joint field work on the part of the two Federal agencies, the collection of data now has been transferred from the direct responsibility of WPA employees in most states to the responsibility of the state department of public welfare. The Social Security Board will begin to receive reports from these state departments for the month of July and will continue the montly publication entitled *Current Statistics of Relief in Rural and Town Areas*.

Total Relief in the United States: Another effort to present the entire situation with regard to public relief in the United States is being made in the monthly bulletin, *Public Assistance, Monthly Statistics for the United States*, where all of the data available from reports of the Works Progress Administration were brought together for April 1937 with those of the Social Security Board. The forthcoming issue for May 1937 will contain data from the Resettlement Administration also.

Social Data about Recipients of Public Assistance: The Division has revised slightly the forms and instructions for the collection of social data about persons accepted for public assistance during the fiscal year 1937–38.

The collection of these data for 1936–37 will be completed by the states on June 30 and the Social Security Board will receive completed tabulations on August 1. It is expected that an important body of information about more than a million cases will be ready for presentation in the Social Security Board's annual report to Congress on January 1, 1938.

Division of Federal Old-Age Benefits Studies. This Division is carrying on a number of studies dealing with the economic and financial problems and effects of the old-age benefits program. The significant statistical data resulting from the old-age benefits wage records will also be analyzed by this Division.

Among the fields in which studies are being carried on are: cost of the old-age benefits program together with the relation of this cost to national income; the incidence of pay-roll taxes under Title VIII and their effects on wages, employment, etc.; the relationship between various benefit formulae and standards of living; and the effects upon the Old-Age Reserve Account of bringing additional groups of employees under the Act. Other studies deal with the effect of business cycles upon the reserve and the economic problems involved in building up and liquidating the funds so held; the effect of Social Security financing upon future trends in interest rates and investment; the differences in economic and social effects resulting from a contributory and non-contributory system of old-age benefits; and an analysis of the extent and mechanisms of savings by income classes together with the forms of investment and liquidation of savings, particularly in different phases of the business cycle.

A sample of about eleven and one-half million persons, taken from the enumeration of employee applications for Social Security account numbers, is now being analyzed with reference to the age, sex, and race composition of the population group with whom the old-age benefits program will be concerned. Further studies bearing on quarterly and annual earnings and employment by numerous categories will be carried on as the regular wage reports from employers are received.

Division of Unemployment Compensation Statistics. By June 17, 35 states and the District of Columbia had installed the industrial classification code approved by the Social Security Board. In most of the other jurisdictions and states, laws have been passed too recently to permit this step. This industrial coding system makes provision for one hundred major industrial groups covering all economic activities. During the latter part of this year, a system of sub-classification within each major industry group will be issued. In general, two digits indicating classification have been included in the employer's number in the ledger accounts of state unemployment compensation agencies.

This system will enable the Social Security Board and state unemployment compensation agencies to secure comparable information on a state and nation-wide basis on subject employers, covered workers, earnings subject to contributions, contributions, delinquencies, and benefit payments,

by industry. In addition, information of the status and solvency of funds available for benefit payments may be secured by industry groups. This latter information, coupled with data on the expansion and contraction of employment by industry may shed light upon the question of merit rating by industry groups. At the present time, steps are being taken to incorporate the system of industrial classification in conjunction with Federal old-age benefits as a means of obtaining statistical information by industry.

BUREAU OF LABOR STATISTICS, U. S. DEPARTMENT OF LABOR.—There is now in press a bulletin reviewing the history of strikes in the United States, and bringing together all the statistical data available from 1880 to the end of 1936. There is also included a brief account of the methods used in the collection and interpretation of strike statistics by the Department of Labor and by the Bureau of the Census in earlier years.

Material collected in the urban study of consumer purchases is being published in a series of brief reports by cities, giving detailed statistics on sources and amount of family income, rentals paid by families of business, professional, clerical, and workers' families, and the proportion of families owning their own homes. These special reports are being issued in advance of the more comprehensive report on consumer purchases in general.

In connection with its regular monthly reports on "Trend of Employment and Pay Rolls," the Bureau has secured fairly comprehensive data on earnings and employment among clerical workers in manufacturing establishments. These data are now being tabulated and the completed report will show the changes in volume of employment and earnings in identical establishments in January, June, and December, 1935, and in June and December, 1936.

The special survey of causes of accidents in a small sample of the construction industry has been followed by a similar study of causes of accidents in the fertilizer industry. This newly initiated research in a field which has been very little explored will be continued during the current year and it is hoped to enlarge the coverage. Concurrently the regular accident reporting for the Bureau's annual surveys of accident statistics is being increased in coverage from 7,000 to approximately 50,000 manufacturing establishments. Also, the number of industries covered is being increased from 30 to 50, including public utilities.

The work of redistributing the rent sample used by the Bureau in its cost-of-living surveys has been completed in 8 representative and widely distributed cities and will be completed for 6 additional cities by September. Rental data for the new sample are being collected for all price-reporting periods from March 1935 to date. The retail price section has also classified retail prices of coal according to sizes.

A survey of wage rates actually paid to union and non-union construction industry employees has been completed. Payments are shown by occupation, race, and degree of skill of workers, and by city. The data are assembled

for residential and nonresidential and public and private building. A summary of the results will appear in the *Monthly Labor Review* and a more detailed report will be issued later in bulletin form.

UNITED STATES EMPLOYMENT SERVICE.—Work on a detailed survey of the characteristics and distribution of over 5 million persons, who were actively registered with offices of the United States Employment Service in search of work during July, is now nearing completion. This survey, which is similar in nature to several previous inventories of the Employment Service active file, discusses the occupational and industrial classifications of the workers, the age, sex, color, and geographical distribution. A report also will be included of the registration and placement activities of the Employment Service during the three months of April through June.

A similar study was made as of April 1st, and a new one is proposed to be prepared analyzing the job-seekers registered during October.

At the present time the Worker-Analysis Section is conducting research in five different occupations. Preliminary results have warranted a continuation of the study of department store salespersons and a third sample is now being studied. Standardization of selection procedures for card punch operators, coders, garment machine operators, and lamp shade sewers is in process. Oral trade questions for jobs in the foundry industry, machine shops, lumber and woodworking industry, hotels, restaurants, and mechanical service and repair industry are in the process of verification. Questions for jobs in the construction industry have been verified and are now in use in certain public employment offices.

DIVISION OF SOCIAL RESEARCH, WORKS PROGRESS ADMINISTRATION.—*Current Statistics of Relief in Rural and Town Areas.* The monthly indexes of expenditures for six types of relief in rural and town areas, prepared by the Division of Social Research, have been computed back to January 1932. Data are reported currently for 385 areas in 36 states. State welfare agencies in each state have now assumed responsibility for the reporting series. Work is in progress on a bulletin concerning the five years of rural relief covered by the series.

Youth Estimates. The Rural Research Unit has made estimates of the youth population (16 to 24 years of age) of the United States from 1930 to 1952. The method used is the application of the probable mortality rates to the persons of various ages listed by the Census in 1930 who would fall in the 16 to 24 year age group in subsequent years. For persons born in 1925 or thereafter the annual number of registered births was used. These estimates show that, in so far as numbers may be an index of the severity of the youth problem, the peak will be reached between 1940 and 1945. The number of rural youth in 1935, by states, has also been estimated.

The Migratory-Casual Worker. This recently issued monograph is based on interviews and the 1933 and 1934 work histories of casual laborers in agriculture and industry. The monograph considers the nature of the workers

and their jobs, the economic and personal factors which lead to migration, typical migration patterns, the substandard economic position of the workers, their needs, and the prospects of improving their economic and social status in the future.

Labor Shortage Studies. The Division has attempted to develop procedures for a quick type of survey which will obtain information for administrative use in the shortest time and most systematic manner possible. These procedures were used during the period of seasonal demand, for cannery and farm labor, when numerous investigations were made of reported labor shortages alleged to be the result of relief policies. No shortages due to relief policies were found. The difficulties in securing labor were largely due to a wage scale below the prevailing rates in other industries, and to the seasonal character of the work. Other studies were made in northern New England of the shortage of woodsmen, which was due to an unusually high demand for labor. Very few experienced woodsmen who would be acceptable to employers were employed on WPA projects or were receiving local relief.

Publications Under Cooperative Plan of Rural Research. Under the Cooperative Plan of Rural Research, more than 150 bulletins prepared by the State Supervisors of Rural Research have been published or approved for publication. These reports deal primarily with various aspects of the rural relief situation in individual states. They are available at the state agricultural experiment stations. States for which bulletins have been issued include: Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Georgia, Illinois, Iowa, Kentucky, Louisiana, Maryland, Minnesota, Missouri, Montana, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, and Wisconsin.

Survey of Public Assistance Extended to Households in the Drought Areas. A 100 per cent enumeration was made of all households receiving aid in 64 sample counties in 10 Great Plains States from July 1 through December 31, 1936. Tabulations are now in progress. One of the primary objectives of this study is the determination of the amount of duplication of relief activities among households receiving public assistance in the drought area.

The publications of the Division not previously listed are as follows: *Urban Workers on Relief, Part II—The Occupational Characteristics of Workers on Relief in 79 Cities, May 1934;* and *Current Statistics of Relief in Rural and Town Areas, for February–March 1937 and for the Years 1932–1936; and also for March–April 1937.*

In addition, work is in progress on monographs, now in manuscript form, which deal with the cost of living in 59 cities, relief benefits under the FERA, trends in relief expenditures 1910–1935, part-time farming in the southeast, migrant families, changing aspects of urban relief, changing aspects of rural relief, rural youth on relief, the rural family in the depression, the village and the depression, industrial and educational backgrounds of workers on relief in March, 1935, and legislative aspects of public welfare.

DIVISION OF RESEARCH, STATISTICS AND RECORDS, WORKS PROGRESS ADMINISTRATION.—*Works Program Statistics.* With the beginning of a new fiscal year, certain changes are being made in the statistical reporting system of the Works Progress Administration. The changes are dictated both by the reduced level of Works Program operations contemplated during the coming year and by the experience gained in two years of statistical reporting. Consideration is being given to consolidation of some of the twelve area statistical offices established for the tabulation of primary operating documents from which the reports are derived. Substantial reduction of the personnel in these offices has been accomplished. Further use of mechanical tabulating equipment is likely.

Report forms have been subject to careful review. The semi-monthly employment reports have been discontinued as has been the monthly Works Program employment report by county of residence of the worker. Data on employment, hours, and earnings continue to be obtained on a monthly basis by location of project operation. Attention has been directed toward a closer integration of statistical reporting and the requirements of Works Program administration both in the states and in the central office.

The June 1937 issue "Report on the Progress of the Works Program" summarizes operations under the Works Program through May 31, 1937, and includes discussions of employment, funds, projects, and other information of general interest.

A *History and Evaluation of Work Relief through 1935* is nearing completion.

A study is under way in the Construction Statistics Section to examine the nature and cause of seasonality in construction employment. The report of the President's Conference on Unemployment, published in 1924 under the title "Seasonal Operations in the Construction Industry," contended that custom, not climate, was the major cause of such seasonal unemployment, and further that changes in construction technology were causing an increase in winter employment. Statistical materials already examined fail to offer support to these contentions.

A report by this section which includes estimates of total dollar volume of construction and construction employment has been completely revised. The revised figures show employment by sources of funds and types of construction. Employment estimates show the high, low, and average for each year since 1925, through 1936.

The Labor Research Section has completed extensive tabulations of available information concerning hourly wage rates paid in public and private construction for 25 occupational groups during 1936. These data cover approximately 1,000 different communities in the United States. A second series of tables showing hourly rates, monthly hours of work and monthly earnings on WPA work projects for eight important occupations has also been completed. These data cover every county in the United States as of December 31, 1936.

Relief Statistics. From September 30, 1936, until the last of April, 1937, the work of obtaining, compiling, and analyzing for publication reports of general relief administered by state and local governments was performed by a joint office of the Works Progress Administration and the Social Security Board. The professional staff consulted with the Advisory Committee on the Collection of General Relief Statistics on matters of policy and also questions of technique and procedures. (See March and June issues of this JOURNAL.)

At the end of April an agreement was reached between the Works Progress Administration and the Social Security Board for the transfer of complete responsibility for national reporting of general relief statistics to the latter agency. This transfer involves the continuation of all work in connection with the collection of monthly data previously reported to the Federal Emergency Relief Administration on relief recipients, amounts of relief extended, and administrative and total costs of general relief. The regular monthly releases of these data are being continued as joint publications of the Social Security Board and the Federal Emergency Relief Administration throughout the first quarter of 1937 and thereafter will be continued in equivalent form by the Board. The Board will continue efforts in all states to retain and improve the coverage and quality of, and to expedite the submission of, current and delinquent general relief reports. Changes in instructions to the state relief agencies regarding the preparation of reports or the discontinuation of any items previously reported will be cleared with the Central Statistical Board and the Works Progress Administration before such action is taken.

The Advisory Committee on the Collection of General Relief Statistics will continue to serve in the same capacity as under the joint arrangement between the two agencies. Miss Helen R. Jeter, Director of the Division of Public Assistance Statistics, has been designated by the Social Security Board to take the place of Ewan Clague on the Committee. Other members of the Committee are Ralph G. Hurlin, Chairman, Frederick F. Stephan, Paul Webbink, and Emerson Ross.

With the consummation of this agreement, members of the staff of the joint office of the Advisory Committee on the Collection of General Relief Statistics returned to the statistical divisions of the agencies which had furnished their services during the interim arrangement. Certain work which was under way at the time the joint staff was liquidated is being carried on by a small technical group in the Works Progress Administration under the immediate direction of Thomas B. Rhodes, who has served as Secretary of the Advisory Committee. This work includes a review of all available statistics of relief activities of Federal, State, and local governments with a view to the possible integration and periodic publication of such data.

The first step in the direction of the regular publication of data for all relief programs was the issuance by the Works Progress Administration of a bulletin entitled "Summary of Statistics of Relief in the United States

in 1936." This publication received wide distribution at the National Conference of Social Work held in Indianapolis in the last week of May 1937.

National Research Project, Works Progress Administration. Previous issues of this JOURNAL have carried outlines of the work undertaken by this Project. In other pages of the present issue will be found reports of meetings respectively of the Philadelphia and the Washington chapters of the American Statistical Association at which the research program of the Project, as well as methods, problems, and some preliminary findings, were presented by various members of the Project's staff.

As of July 1, the following reports have been released: "Unemployment and Increasing Productivity" and "Technology and the Mineral Industries" (prepared as chapters in a forthcoming publication of the National Resources Committee entitled *Technological Trends and their Social Implications*); and "Small Scale Placer Mines as a Source of Gold, Employment and Livelihood in 1935."

Reports in press include the following: "Employment and Related Statistics of Coal Mines in 1935," "Changes in Labor, Equipment, and Methods Used in Producing Sugar Beets," "Length and Changes in the Farm Work-Day," and "Mechanical Cotton Harvesting."

WOMEN'S BUREAU, U. S. DEPARTMENT OF LABOR.—The Women's Bureau made a study, during the first three months of 1937, of earnings and hours worked by men and women in the woman-employing industries of Florida. A total of almost 28,000 employees in 265 establishments were included. A preliminary report has been released in mimeographed form and the final report is now being prepared.

At the request of the District Committee of the House of Representatives, the Women's Bureau made a survey of the hours and wages of women workers in the chief woman-employing industries in the District of Columbia. The survey was conducted in March and April of 1937. About 200 establishments were covered and pay-roll records obtained for over 12,500 women. The industries surveyed included factories, department, limited-price and ready-to-wear stores, laundries, cleaning and dyeing plants, beauty shops, hotels, and restaurants. No attempt was made to cover Government service or household employment, and offices were not surveyed but data concerning office workers in the various industries covered were secured and these have been reported separately. A preliminary report has been released in mimeographed form and the final report will soon be available from the printers.

METROPOLITAN LIFE INSURANCE COMPANY.—The Statistical Bureau of the Metropolitan Insurance Company announces the publication in early fall of a volume entitled *Twenty-five Years of Health Progress*, a study of the mortality experience among the Company's Industrial policyholders covering the 25-year period, 1911 to 1935.

Represented here is the experience of 346½ million years of life in the wage-

earning population of the United States and Canada. During the quarter century over 3 million deaths were recorded. From the record of these deaths, analyzed by sex, color and age, has come a well-defined picture of the remarkable progress of medicine and public health in the two countries within the quarter century.

The volume offers an orderly presentation of the trends that have taken place in the mortality from each of the more important causes of death, and the factors influencing the broad movements of the death rates. Such developments as the control of tuberculosis and the improved treatment of diabetes, pernicious anemia, and other diseases, particularly those of children and young adults, are clearly outlined in this study. In a special chapter is described the relationship between the decreasing mortality and the increasing average length of life.

Meticulous care has been taken to insure the accuracy of the information presented. Not only has modern statistical technique been used in analyzing the raw material derived from the death claims, but the death claims themselves have been carefully checked and verified.

The chapters are as follows: The General Mortality from All Causes, The Trend of Longevity over the Twenty-five Year Period, The Principal Communicable Diseases of Childhood, Tuberculosis, Influenza and Pneumonia, Cancer, Cardiovascular-renal Diseases, Diabetes, Diseases of the Puerperal State, Miscellaneous Diseases of Relatively Minor Importance, and External Causes of Death. In addition to over 500 pages of text, the study includes about 75 pages of basic tables and an ample index.

INDUSTRIAL RESEARCH DEPARTMENT, UNIVERSITY OF PENNSYLVANIA.—In appreciation of the research in commodity prices which has already been done by the Industrial Research Department, the Wetherill family has recently given to the University of Pennsylvania all of its records. This collection, which is housed in the Department, begins with a day book in 1762 and traces the development of the business which was started by Samuel Wetherill and which was in the Wetherill family for seven generations, eventually being known as Wetherill & Brother. The majority of the records trace the founding and growth of the first firm to manufacture white lead in this country; the remainder of the collection includes the records of other enterprises in which the Wetherills were interested at various times: a store, a chemical works, a glass factory, a textile mill, and anthracite mining. The possession of these records by the Department has a two-fold significance: (1) it facilitates future work on the analysis and interpretation of this unusually comprehensive collection of business records; (2) it furnishes the nucleus for the future development of a library of original documents tracing the economic growth of Philadelphia.

The Industrial Research Department of the Wharton School of Finance and Commerce of the University of Pennsylvania has published through the University of Pennsylvania Press a third volume on the subject of com-

modity prices in Philadelphia—"Wholesale Prices in Philadelphia—Part II: Series of Relative Monthly Prices," by Anne Bezanson, Robert D. Gray, and Miriam Hussey.

These detailed tables are the source materials of Part I of the volume which studied the price behavior of 186 commodities during the significant period of seventy-eight years of American business activity. The material in this part represents the data from which the group, sub-group, and summary totals were obtained, and can be used in comparisons with commodity prices of other areas or with other data of Philadelphia. The prices for over two hundred specifications are expressed in terms of their average monthly prices of 1821 to 1825. The absolute base, and the unit in which it is quoted, is given for each commodity, and adequate footnotes make clear any changes in description. A few pages of explanatory text precede the tables.

NATIONAL INDUSTRIAL CONFERENCE BOARD.—The Board's Division of Industrial Management continues its studies of industrial and labor affairs by the questionnaire method. "Personnel Practices Governing Factory and Office Administration" recently issued is a statistical summary of what is done in 788 manufacturing establishments, employing upwards of one million wage earners, and 453 concerns with upwards of 300,000 clerical workers, regarding innumerable details of procedure. It answers for the personnel department of any concern the question what other establishments are doing under like circumstances. The Division has under way an investigation of wage differentials in which, by means of questionnaires, it will seek to show the existing wage differentials for specific occupations as well as for industries as a whole.

The Board has utilized the *Ministry of Labour Gazette's* recently published figures for earnings and hours to establish for selected industries "Workers, Earnings and Hours in Great Britain" a comparison with the figures collected for the United States Bureau of Labor Statistics. For the Chemical Alliance the Board has under way an extensive statistical study of labor conditions in the chemical industry. This will be distinguished by the effort to secure classified information regarding the annual as well as weekly earnings of wage earners and the weekly earnings of salaried employees.

In the field of public finance, the "Cost of Government in the United States, 1934–1936" carries forward a series which has become known as the most authoritative collection of data regarding state and local expenditures, tax collections and debt. A useful compendium of "Sales Taxes," state, Federal, and local has been issued. The Department of Public Finance is engaged in a study of "Experience under the Undistributed Profit Tax." A study of "Chain Store Taxes" will be published shortly.

The study of the "Economic Development of Germany under National Socialism" is replete with statistical analysis of conditions in modern Germany. It is the first of a series of practical studies of collectivism. It is proposed to take up shortly conditions in Italy and Soviet Russia, the Board

sending, as in the case of Germany, an experienced investigator to those countries to assemble the material at first hand.

In the field of general economics a study of "International Raw Commodity Price Control" is well advanced towards completion. This study includes an exhaustive statistical analysis of raw material and foodstuffs prices in international markets, in original and United States currencies, in relation to visible supplies as well as in relation to control measures.

The publication of new data necessitated a review of the Board's unemployment studies. The result of this study "Revised Estimates of Employment and Unemployment" is accompanied by "Notes on Methods of Estimating Employment" which should be of interest to workers in this statistical field.

The volume "Income Received in the Various States, 1929–1935" mentioned in the last issue of this JOURNAL is now ready. It gives for each state an estimate of the amount of income arising from each industrial source, and the amount of income of each type. Income studies for different branches of activity such as iron and steel manufacturing and the motor vehicle industry are being prosecuted, and other phases of the national income will be studied in the future.

CHAPTER ACTIVITIES

THE ALBANY CHAPTER.—There was a meeting of the Albany Chapter on May 6, 1937. Dr. Roy Gillett presented a brief report for the Committee on Coordination of State Statistics. Dr. A. K. Getman presented a brief discussion of managed currency. The principal address of the evening was given by Dr. Mordecai Ezekiel, Economic Adviser to the Secretary of Agriculture, on the subject, "A Statistician's Responsibility for a Better Ordered Economy."

The Chapter held a dinner meeting at the Candle Light Inn on June 10, with Dr. W. W. Coxe, President, in the chair. Thirty members and guests were present. The following officers were elected for the ensuing year: President, Fred J. Decker, New York State Department of Civil Service; Vice-President, Roland F. Bucknam, Public Service Commission of New York; Directors, Edward H. Van Winkle, Rensselaer Polytechnic Institute, and Marjorie Gooch, New York State Health Department.

Dr. V. B. Hart of the staff of the Department of Agricultural Economics and Farm Management at Cornell University gave a very instructive talk on the subject of "Gold and Prices."

THE BOSTON CHAPTER.—A special meeting of the Boston Chapter was held on May 7, 1937, at the office of the United Business Service. There were 32 present as guests of the United Business Service, which organization provided a very enjoyable buffet supper. Prior to the supper those present had an opportunity to observe the commodious offices and modern equipment in the five-story remodeled building occupied by the Service.

At the speaking session, Mr. Frederick F. Stephan, Secretary of the American Statistical Association, spoke briefly with reference to "Recent Developments in Statistical Work and the Participation of the Association Therein."

Dr. Lucile Eaves, Professor Emerita, Simmons College, Boston, gave an address on "Discrimination in Employment Against Older Wage-Earners." Dr. Eaves has made a thorough study of the results of a recent report on this subject by the Massachusetts Department of Labor and Industries, and has written a review of the report, which was published by the United States Bureau of Labor Statistics in the *Monthly Labor Review* for June, 1937 (pages 1359–1386), which review includes statistical tables and charts to which she referred in her address. The report was the basis for an Act passed by the Massachusetts Legislature and approved by the Governor on May 27, 1937, entitled "An Act Prohibiting Discrimination Against Certain Persons in Employment on Account of their Age."

THE CHICAGO CHAPTER.—At the annual meeting of the Chicago Chapter held on April 26, 1937, the following officers were elected for the coming year beginning October 1: President, John H. Noble, Armour and Co.; Vice-President, Henry B. Arthur, Swift and Co.; Secretary-Treasurer, Miss

Frances Hay, Standard Oil of Indiana; and Directors: H. B. Stair, Illinois Bell Telephone Company; Dr. T. O. Yntema, University of Chicago; and W. B. Ricketts, Booz, Fry, Allen and Hamilton. Membership of the Chapter as of the annual meeting totaled 128.

THE CINCINNATI CHAPTER.—The newest chapter of the family in the national organization was granted a charter in May of this year. As a local organization, however, the group dates back to 1934, when Dr. F. E. Wolfe (now president), Professor W. A. Baude and Dr. Paul Horst (both now on the executive committee), and Dr. Albert K. Kurtz (now in New Haven) met together and decided that a statistical group was needed in Cincinnati. They invited their friends. Since then, the group has met five to seven times each year.

This spring the group realized that it had grown beyond the bounds of an informal organization. The members wanted the stimulation of an organic relationship with the national association, and they wished to cooperate with the work of the larger body. Accordingly, a constitution was adopted, vesting control in an executive committee composed of the president and the two immediately past presidents, and a petition was submitted to the American Statistical Association for a charter as a chapter. The petition was approved in May by the Board of Directors of the Association.

The first meeting held by the group in its new role as an official chapter of the American Statistical Association was led by the secretary and district representative, Douglas E. Scates, on May 13. Dr. Scates read a paper on "Methods of Combining and Averaging Product-Moment Correlations."

The programs for the meetings held by the local group during the past winter are as follows: Robert D. Kahl, "Statistical Methods in Sales Analysis," March 25, 1937; F. E. Wolfe, "What Does Homogeneity Mean?" February 25, 1937; Paul Horst, "Prediction with Allowance for Errors in the Independent Variables," January 14, 1937; and Ellery F. Reed, "Statistical Methods in Social Case Work," October 22, 1936.

THE CLEVELAND CHAPTER.—The Business Statistics Section of the Cleveland Chapter spent an interesting afternoon on April 26 at the Nela Park offices of the General Electric Company.

On May 20 the tenth annual meeting of the Chapter was held at the Cleveland Chamber of Commerce Club. 55 members and guests were present. President L. M. Whittington presided. Dr. Frank T. Carlton was elected President and Mr. John W. Love, Vice-President, of the Chapter for 1937–38.

Three papers were presented at the meeting. Mr. David C. Elliott, Chief Statistician of the Reconstruction Finance Corporation and a former member of the Cleveland Chapter, spoke on "Changes in the Spending Habits of Business." In a study of data from 150 manufacturing concerns, Mr. Elliott concluded that in view of the backlog of orders inventories are not burdensome at present. While inventories were 90 per cent higher in 1936 than in 1935, a 15 per cent gain after an adjustment for higher prices and 14 per cent

higher than in 1929 after an adjustment for price changes, new orders are greatly in excess of last year. Mr. Elliott discussed next the effect of the new surtax on undistributed profits on the cash positions. He discovered that while net earnings have been less than in 1929, dividends have been higher. He found that the increase in net working capital was small in 1936 and that some new financing may be necessary to bolster the cash position. The data showed that the cost of sales has been rising somewhat more rapidly than sales, but he concluded that the trend is not important with rising business.

Agnes Brooks Young, Regional Director of the Fashion Group, discussed the results of her study of "The Recurring Cycles of Fashion." Mrs. Young's original purpose had been to discover the relationship between fashions and the business cycle. Her results forced her to abandon any idea of correlation. Her study for the more recent times was based on measurements and styles appearing in the fashion magazines. Separate tabulations were shown for skirts, waists, collars, sleeves, etc. The talk was illustrated with slides. The discussion of the recurring cycle of skirt styles from tubular to bell shaped to back flare and back to tubular was particularly interesting.

Mr. Merle Hostetler, a lecturer on banking and finance at Cleveland College spoke on the "Turning Points in Business Cycles." His talk was based on a large folded grid which showed the cyclical fluctuations of industrial production by months over the past century. Numerous notes were included on the grid to explain the cyclical movements of the curve. The notes included comments on legislation, price trends, banking and finance, important inventories, major disasters, political events, etc. Copies of the grid were distributed among the guests for reference during the address.

THE CONNECTICUT CHAPTER.—A meeting of the Chapter was held on April 19. Mr. Robett Parnall, Manager of the Hospital Service Fund of New Haven spoke on "Statistical Bases of Hospital Service Plans."

THE NEW YORK DISTRICT CHAPTER.—One hundred and fifty members of the Association met at the Aldine Club on the evening of May 28 for a discussion of the economic effects of fiscal policies. The principal speakers were Sir Josiah Stamp, Dr. Carl Snyder, and Colonel Leonard P. Ayres. Dr. W. Randolph Burgess presided.

The subject of the evening's discussion was the economic effects of fiscal policies. Mr. Stamp introduced his remarks with a brief description of the difference between the incidence and the effects of taxation. He discussed the increasing use of taxation to influence economic activity and analyzed the immediate and long-term effects of taxing undistributed profits. Colonel Ayres discussed a number of popular opinions with respect to government, economics and business, which the people of the United States have been taught to believe and which have guided the fiscal policy of the present Administration. Mr. Snyder discussed the effects of the redistribution of

wealth in a socialminded civilization upon the continued growth of capital. An extended general discussion followed.

The first meeting of the Public Health Section of the New York Chapter was held on June 15th at the Town Hall Club in New York City. The subject under discussion was "Mortality Connected With Childbirth." Dr. John L. Rice, Commissioner of Health was the presiding officer and the speakers included: Dr. John Collinson, Assistant Chief Statistician for Vital Statistics of the U. S. Bureau of the Census; Miss Katharine F. Lenroot, Chief of the U. S. Children's Bureau; Miss Elizabeth C. Tandy of the U. S. Children's Bureau; Dr. Herman Bundesen, President of the Board of Health of Chicago; Miss Hazel Corbin, Director of the Maternity Center Association of New York City; Dr. George W. Kosmak Editor of the *American Journal of Obstetrics and Gynecology*.

Dr. Collinson discussed the inconsistencies that exist between the statistics of various countries and how the comparability of their rates is affected and pointed out that to obtain comparability between nations, definitions must be made uniform, and coding and classification must be standardized.

Miss Lenroot reported on the activities of the Maternal and Child Health Division of the U. S. Children's Bureau and discussed recommendations made to the Bureau which cover increased and improved maternity care and care of the newborn, and a program of training in these fields for physicians and nurses.

Dr. Bundesen spoke on the important factors responsible for failure further to reduce infant mortality and stressed the fact that if the health officer is to do anything in the way of preventing neonatal deaths he must first be able to measure the problem. He reported on 500 autopsies which were performed on infants in Chicago and explained in detail how the assigned causes of the neonatal deaths were corrected after autopsy.

Miss Tandy reported on the Children's Bureau study of stillbirths which is being made with the cooperation of the Committee on Stillbirths and with more than 216 hospitals. It is believed that rules can ultimately be worked out which will supply the ground work for statistical information on a nation-wide scale with respect to the fetal and maternal conditions underlying mortality from stillbirths. Miss Tandy presented a number of charts to the group which showed graphically the results of the preliminary analysis of the material gathered so far.

Miss Corbin told of what is happening in New York City where half of the mothers receive no care at all until after the sixth month of pregnancy. She spoke of the overcrowding in the municipal hospitals and reported that 3,475 women were delivered in their homes by midwives. Miss Corbin briefly outlined a plan which would save women from the humiliation of shopping around for doctors to deliver their babies at a price which they could afford to pay.

Dr. Kosmak spoke from the point of view of the obstetrician and said that though 50 per cent of the puerperal deaths are avoidable, the desire

for painless labor, for short cuts in delivery, and for sacrifice of safety to comfort have all had a bearing on our high rates. Dr. Kosmak noted that there is hope for obstetrics if we can develop a closer bond of appreciation between the art and the science of this branch of medicine, and the statistician should interpret his findings in the best interest of the mothers and the medical profession.

This first meeting of the Public Health Section was attended by 85 people interested in statistics and maternity and infant welfare. While no definite plans have been made as yet, it is hoped that there will be another meeting of this group in the fall.

The program committee consisted of: Miss Jessamine S. Whitney, Chairman, Mary Augusta Clark, Thomas J. Duffield, Dr. Hugo Muench, Dr. W. Frank Walker, and Mrs. Helen Slade, District Representative.

THE PHILADELPHIA CHAPTER.—The last meeting for the season for the Philadelphia Chapter was on Friday, May 7th, and concerned "Studies in the Impact of Technological Change in Employment."

Mr. David Weintraub, Director of the National Research Project of the Works Progress Administration, spoke briefly on the general problems involved.

Mr. Irving Kaplan, Associate Director of the National Research Project on Reemployment Opportunities and Recent Changes in Industrial Techniques, spoke about the research program. Dr. Harry Jerome discussed the "Place of Individual Plant Histories in a Productivity Survey." Mr. J. A. Hopkins spoke concerning "Trends in Employment in Agriculture and Basic Causes as Exemplified by Data for the Corn Crop." Dr. Gladys L. Palmer of the Industrial Research Department, University of Pennsylvania, described briefly the studies of the Philadelphia labor market which are being conducted by the National Research Project in cooperation with the Industrial Research Department of the University of Pennsylvania. These papers were presented at a later date to the Washington Statistical Society. They are reported on pages 571–577 of this JOURNAL.

At the annual business meeting, the following officers were elected for the ensuing year: President, Dr. Hiram S. Davis, Department of Industrial Research, University of Pennsylvania; Vice-President, Dr. Parker Bursk, Wharton School, University of Pennsylvania; and Secretary, Mr. Robert D. Gray, Department of Industrial Research, University of Pennsylvania.

THE PITTSBURGH CHAPTER.—The Pittsburgh Chapter met on April 30 to hear a discussion by Mr. D. Walton Matthews, President of Bondex, Incorporated, of New York City, on "Handling a Bond Account in Accordance with Economic Trends." Mr. Matthews emphasized the importance of a comprehensive classification of bonds according to their credit rating and according to their reactions to changing economic conditions.

At a meeting of the Chapter on May 27 Mr. Calvin E. Cohen, Field Representative of the U. S. Treasury Department, spoke on "Differences in

Sentiment between the East and the West." His address was primarily related to the issue of "Baby Bonds" and the differences between the East and the West in the popularity of these bonds.

On June 1 the Chapter met with the Hungry Club to hear Dr. Harold G. Moulton, President of the Brookings Institution, speak on "Are Shorter Hours, High Wages, and Public Works a Cure for Unemployment?"

THE SAN FRANCISCO CHAPTER.—At a meeting of the San Francisco Chapter on April 22, 1937, Mr. Adalbert Wolff, Investment Analyst, Brush-Slocum and Company, spoke on "Investment Analysis." In considering the purchase of a security, he pointed out that it is necessary to consider the general economic situation, the attractiveness of the industry in question, the position of the company in the industry, and finally its financial record and present state. The remainder of the discussion was directed toward the last of these considerations.

The speaker thought that ratio analysis is of little value for the comparison of industrial companies since their requirements differ, but it may be of excellent advantage in ascertaining the progress of one company over a period of years. Ratio analysis is much more useful in comparing companies in the case of railroads, utilities, banks, or fire insurance companies, and often makes it possible to determine *earning power*, the most important element the common stock should possess.

Similarly, undue emphasis is often given to book value, but book value itself is usually no criterion of actual value. Balance sheets naturally are of prime importance, since they reveal the current position and capital structure of the company. The earnings statement provides a dynamic picture and should be compared item by item with statements of previous years. Statistical or financial analysis presents a view of the company's past operations and present condition, but it cannot provide a dependable answer as to what may be expected of the company in the future. At most, it can lay a foundation for a judgment which must include a broader investigation of the company's position in the industry, the outlook of the industry itself, and general economic conditions.

Dr. Norman J. Silberling in discussing Mr. Wolff's paper called attention to the difficulty encountered by the financial statistician and analyst because the data provided by the usual financial manuals are not strictly comparable from year to year. This work would be greatly facilitated if the manuals provided adjusted figures over long enough periods to afford really significant comparisons and trends for at least the long-established companies. Attention was also called to the deceptive character of the price-earnings ratios as a test of security values, since prices of common shares tend to anticipate movements in earnings. Investment analysts increasingly hold that careful analysis of an industry underlying a security is of prime importance in estimating the trends of earnings in the immediate future.

The second speaker was Dr. Sidney Wilcox, Chief Statistician of the

U. S. Bureau of Labor Statistics, who described the Federal Works Project for the study of consumer purchases, jointly conducted by the Bureau of Labor Statistics of the U. S. Department of Labor, the Bureau of Home Economics of the U. S. Department of Agriculture, and the National Resources Committee.

The Chapter met on June 11, 1937, to hear Dr. Halbert L. Dunn, Chief Statistician for Vital Statistics of the Bureau of the Census, discuss "Recent Trends in Vital Statistics." After a short discussion of the history of vital statistics in the United States, and the development of the birth and death registration areas by the adoption of the Model Law, Dr. Dunn gave a panoramic picture of the field of vital statistics. In general, he described a threefold interest and need for vital statistics. Most important is the need of the individual citizen for legal proof of nationality, date of birth, date of death, and parentage, all of which are contained on the birth and death certificate. With the increasing emphasis placed on social security, it is rapidly becoming imperative for every citizen to have a birth certificate. The uses of the Health Department for both birth and death certificates are more generally appreciated. The birth certificate is the start of the maternal and child welfare program, and the death certificate is essential in the control of contagious diseases, and the study of the effectiveness of the general health program.

The accuracy of reported causes of death was discussed in some detail. Statistical tabulations on residence allocation of birth and death are of particular value to the administration of the health departments. Supplemental studies extending from the birth and death certificate will be developed and are of value to health departments.

In addition to the legal use of the certificate for the citizen and the health department needs, there are a variety of statistical interests and sociological values in vital statistics. These are largely involved with statistical tabulations leading to life tables, study of fertility, the falling birth rate, illegitimacy, population estimates, occupational causes of death, internal migration, and social security needs. The outstanding problems facing the extension of vital statistics are not statistical but field difficulties in gathering the material. There is still a considerable amount of work to be done in getting completeness of registration of births in rural areas and obtaining a greater accuracy of the material on the birth and death certificate.

The possibility of linking the solution of these problems with existing agencies, such as, developing county health units, county educational systems, county welfare work, and various types of social activities in the county, was considered by the speaker.

THE WASHINGTON STATISTICAL SOCIETY.—The annual business meeting for the election of officers of the Chapter for the coming year was held on June 10, 1937. O. E. Kiessling of the U. S. Bureau of Mines, who during the year 1936–37 has served as a member of the Executive Committee, was elected to the office of President. Ewan Clague of the Social Security Board,

the outgoing President of the Chapter, was elected Vice-President for the coming year. The membership of the Executive Committee will be announced at the first meeting of the fall.

Under the presidency of Mr. Clague, seven meetings of the Chapter have been held, the first four of which have been reported in earlier issues of the JOURNAL. On April 28th, a meeting was held at George Washington University to consider the use of sampling methods in measuring unemployment. Frederick F. Stephan, Secretary of the American Statistical Association, presided. Since this meeting was a continuation of discussion of the same general subject at two previous meetings, no formal papers were presented. Among those taking an active part in the discussion were Aryness Joy of the Central Statistical Board, Edna Lonigan of the U. S. Treasury Department, Loring Wood of the Bureau of Labor Statistics, and Robert Nathan of the Bureau of Foreign and Domestic Commerce. Considerable interest in this general topic has been evidenced, each of the three meetings having been attended by more than 200 persons.

A group meeting of the Chapter was held at George Washington University on May 5th to discuss a simplified method of solving normal equations developed by H. B. Richardson of the Cotton Marketing Service of the Department of Agriculture. This meeting, attended by about 30 members, was called at the suggestion of E. K. Karrer, of the Cotton Marketing Service, who led the discussion.

On June 10 the Washington Statistical Society Chapter of the American Statistical Association held a meeting under the auspices of the Works Progress Administration. The subject of discussion was "The Research Program of the National Research Project on Reemployment Opportunities and Recent Changes in Industrial Techniques." The meeting was arranged by the Works Progress Administration to acquaint members of the technical and research staffs of the Federal agencies cooperating in the National Research Project with the Project's research program. Because of widespread interest in the subject, it was decided to hold the meeting jointly with the Washington Statistical Society. Approximately 500 persons attended the meeting, which was held in the auditorium of the Department of Commerce.

A paper on "The Research Program of the National Research Project," prepared by Mr. Irving Kaplan, Associate Director of the Project, was distributed to all members of the Society in advance of the meeting. Mr. Kaplan's statement outlined the scope of the Project's work and described the approach and perspective which has guided the undertaking.

The presiding officer, Mr. Corrington Gill, Assistant Administrator of the Works Progress Administration, introduced Mr. Harry L. Hopkins, Administrator of the Works Program. Mr. Hopkins in a few words sketched the background of the considerations which resulted in the establishment of the Project.

In introducing the speakers Mr. David Weintraub, Director of the Project, pointed out that the Project's approach went beyond the study of iso-

lated processes and the oversimplified formulation of the problem as being merely one of man versus machines, to a program aimed at determining when and how technological changes take place and how these changes affect the trends in production and employment, and the incidence of unemployment. "This approach compels the study of technological change in terms of social savings gained from technological advance, the distribution of these savings between capital and labor, and the effect of the changing character of this distribution on the nation's income, production, and employment. Within this general approach we also consider the impact of technology on specific industrial situations involving particular industries, occupations, and individuals."

Mr. Weintraub also acknowledged the cooperation of a number of governmental and private agencies which had previously done work within the field or which had collected data valuable for the Project's analyses. These include the Department of Agriculture, the Bureau of Mines of the Department of the Interior, the Bureau of Labor Statistics of the Department of Labor, the Railroad Retirement Board, the Social Security Board, the Bureau of Internal Revenue of the Department of Treasury, the Department of Commerce, the Federal Trade Commission, the Tariff Commission, the Industrial Research Department of the University of Pennsylvania, the National Bureau of Economic Research, the Employment Stabilization Research Institute of the University of Minnesota, and the Agricultural Economics Departments in the Agricultural Experiment Stations of California, Iowa, Illinois, and New York.

Dr. Harry Jerome, director of a number of surveys in the manufacturing industries—brick and clay products, cement, flour, lumber and beet sugar—spoke on "The Place of Individual Plant Histories in Surveys of Changing Productivity." These surveys were conducted in cooperation with the National Bureau of Economic Research. The approach in these surveys is to follow up the determination of the rate of change in labor productivity with an analysis of the immediate conditions of change in the individual plants affected, and an analysis of the general characteristics of the industry and the period in which the changes took place. Furthermore the studies include a consideration of changes in labor requirements in the production of raw materials, machinery and equipment, and fuel and power consumed, as well as changes in the manufacturing process proper. Drawing illustrations from plant records in the various industries, Dr. Jerome described some of the problems encountered in reducing different products to a common unit of output and in determining plant capacity. Per cent of capacity utilized has been found to have a marked influence on the man-hour ratio. Dr. Jerome also described briefly some of the analyses which are being made of plants grouped by relative efficiency, by age, by size, by geographical location, etc.

Dr. John A. Hopkins, who is conducting the Project's studies in agriculture, spoke on the subject of "Changing Labor Requirements in Agriculture,

as Illustrated by Data on the Corn Crop." Dr. Hopkins used preliminary results of a field survey and other studies of the corn crop to illustrate the problem of analyzing the causes of the decline in the proportion of our population required to supply agricultural raw materials, and the form which this decline has taken in affecting individual farm enterprises. The problem involves the determination of the over-all volume of output and total labor input in agriculture and, second, by examination of production methods in selected key products, the determination of the relative importance of the principal changes in agricultural technology, of shifts in specialization from area to area, and of organization of the typical farm unit. The important influences affecting labor requirements, either per acre or per unit of product, include the number and sequence of operations performed, the amount of power and type of equipment used, the area in which the crop is grown, the variety of seed used, and methods of disease or pest control. Considerable use has been made of data collected by the United States Department of Agriculture and the agricultural experiment stations, but these previous studies are not entirely adequate because of differences in method or in area surveyed and because few cover the entire period, 1909–36, with which the Project is concerned. A field survey in 58 counties during the past summer was designed to fill in gaps in available data. Emphasizing differences between areas due to varying methods of working the crop and to other factors, Dr. Hopkins pointed out that preliminary results showed an average decline of 20 per cent in hours per acre in corn production since 1909, with the area of least change (Eastern Cotton) showing only 8 per cent and the area of greatest change (Western Dairy) 28 per cent. The use of more power and of larger and better adapted equipment is an important factor in this change. In closing, Dr. Hopkins suggested that the decline in total labor required per farm will not be as marked as it is for the corn crop alone, because reduction of labor per head of livestock has been much less rapid, and the labor used on general overhead work—such as repairing fences and cutting weeds along roadsides—has probably not changed greatly.

Dr. O. E. Kiessling, Chief of the Mineral Production and Economics Division of the Bureau of Mines, spoke on "Technical Progress and Productivity in Mining." The Bureau of Mines is cooperating with the National Research Project on a series of mineral technology and output per man studies. Dr. Kiessling described the work which he is supervising in the extractive industries, as, first, developing reliable and relatively long-term series on employment and output per worker and, second, tracing the accompanying technical advances. The talk was illustrated with material from the various industries covered by the studies—bituminous coal, anthracite, petroleum and natural gas, phosphate rock, crushed stone and other nonmetals, iron ore, copper, lead, zinc, silver, and gold. Dr. Kiessling pointed out that increased utilization of mechanical energy overcomes other factors —such as increased physical handicaps in mining, reductions in grades of ore, and the shorter work-day and work-week—and accounts for the sharp

upward movement of ouptut per worker in mining. Other points covered included the following: the varying experience of different regions mining the same product; the increased employment which accompanied increased output per man in petroleum to 1929, as contrasted with most extractive industries which showed declining employment before that year; the adoption of mechanical drilling, loading, hauling and hoisting devices and improved milling in various types of mining; the effects of increased physical difficulties of operation and decreased mineral content of ores in counteracting improved methods; the rise of open-pit mining; shifts of production to new areas of lower-cost operation; and known reserves and the possibility of increasing these by scientific prospecting. Dr. Kiessling concluded with a statement that, in general, output per man in the major mining industries could be expected to increase in the short-run future, though not as rapidly as during the 1920's; that the effect of this on total employment will vary according to total demand for the respective products, with only petroleum likely to increase its man-power requirement over previous levels; that mechanization is changing the kind of workers needed underground, favoring younger men educated to work with machines, and increasing the need for technical men and supervisors; and that the long-run outlook, though the date at which the situation will present itself is not predictable, is clearly one of increasing physical difficulties and increasing costs.

In introducing Dr. M. L. Jacobson, Statistician of the study conducted jointly by the Project and the Railroad Retirement Board, Mr. Weintraub pointed out that the study of the railroad industry included not only the analysis of secondary materials related to employment and productivity, the subject of Dr. Jacobson's paper, but also the analysis of several hundred thousand railroad work histories collected by the Federal Coordinator of Transportation in 1934 and the supplementation of these by a field survey designed to add, for a sample of those workers, employment records during periods of separation from the railroad service and employment and unemployment experience since 1934.

Dr. Jacobson talked on "Employment and Productivity in the Railroad Industry." Since 1921 the value of investment in road and equipment of Class I roads increased from 19.6 to 24.2 billion dollars. The new investment was applied almost entirely to the reduction of costs and improvement of service rather than to new mileage. During the same time employment on railroads was cut nearly in half. The ratio of investment to employment increased about 22 per cent from 1921 to 1929, due primarily to the increase in investment, and increased another 84 per cent after 1929, due almost entirely to the decline of employment. Overhead costs, of course, cannot readily be varied to suit temporary conditions. Thus increased investments, if unaccompanied by increased business, themselves become a force tending to induce further economies in labor costs. The ratio of traffic units to man-hours shows an almost uninterrupted upward trend since 1900 with a further sharp upward turn since 1932. From 1922 to 1935 productivity of train and

engine workers in the freight service rose 82 per cent in terms of gross-ton miles and 68 per cent in terms of revenue ton-miles; these increases reflect largely a 40 per cent reduction in man-hours and a 25 per cent increase in the ratio of deadweight to revenue tons hauled. In general, productivity in the freight service has increased much more than in the passenger service. This is due chiefly to the fact that facilities, employment, and hours are much more readily adaptable to traffic needs in freight than in passenger service. Salient developments in the passenger service include the almost continuous decline in passenger miles since 1920, accompanied by a slight increase in passenger-car miles up to 1929, the large decline in both series during the depression, and the slow recovery of both in the past few years. Productivity of road passenger workers has increased continuously in terms of train miles and car miles, but has declined in terms of passenger miles. Important technological changes affecting productivity of train workers include the increases in average tractive power of locomotives, number of cars per train, and speed between terminals. In summing up, Dr. Jacobson pointed out that, especially since railway traffic began to decline, unemployment engendered by managerial and technical changes has become acute. Technical reconstruction of the industry, which would raise the productivity of workers employed, is far from complete. Nor does it seem likely that industrial recovery of the near future will be sufficient to reemploy in railroad work the great number of men who lost their jobs during the depression.

Mr. Tom Tippett, Associate Sociologist on the Project, described some aspects of the labor market in one of the industrial situations selected by the Project for special study. Mr. Tom Tippett's paper was entitled "The Coal Loading Machine and its Effect on Employment in One West Virginia Coal Field." Scotts Run, a coal field in northern West Virginia, afforded an unusual opportunity for analysis of the effects of technological change on employment. This field was opened up as a producing center during the War, and, in common with other Southern fields, enjoyed a relative prosperity—at least as compared with Northern fields—until about 1927, when production began to decline. After 1929 the decline in production and employment was severe. In 1933 and 1934, with beginnings of a reviving demand for coal, mines reopened, and employment began to climb. In 1935, and especially in 1936, production increased. In 1936 the coal loading machine was extensively introduced in the field, upsetting the promise of a reestablished employment equilibrium. All of the people living in Scotts Run depend directly upon the mines for a livelihood. During 1936, while the loading machine was being installed in one mine after another, almost half of the miners were unemployed. Production per man increased, and younger men, sometimes from outside Scotts Run, were hired to handle the machines.

The final speaker of the evening was Dr. Gladys Palmer, who is in charge of studies which the Project is conducting in cooperation with the Industrial Research Department of the University of Pennsylvania. Dr. Palmer's subject was "Recent Trends in the Philadelphia Labor Market." Philadel-

phia, in contrast to Scott's Run, is a highly diversified commercial and manufacturing city. The series of studies in this labor market have included an employment and unemployment census each year since 1929, and against this background, an analysis of trends in job opportunities, the types of sons who have been, and who have not been, securing jobs, and the occupational mobility of selected groups of workers. Manufacturing employment in Philadelphia is back to the 1929 level (which was much lower than obtained in 1923), but the decline in the unemployment curve has not been as rapid as the rise in business recovery. A partial explanation of this lies in the significant decrease, in the years from 1934 to 1936, in part-time work. Thus the relief load has remained high because it is not so directly affected when a part-time worker obtains full-time employment as it is when an unemployed worker obtains a job. In addition, the population of Philadelphia is older and its families have more employable members than is the case, say, in Detroit; consequently when one member of the family obtains a job it is not always sufficient to enable the family to go off relief. It should also be said that the Philadelphia direct relief load now takes care of a large number of unemployables who eventually will be provided for by other forms of public assistance. Dr. Palmer concluded with a description of some of the objectives of the study of work histories, which will emphasize questions of mobility reflected in occupation, industry and employer shifts, and the relation of age and skill to occupational mobility and to employment and unemployment experience. The groups selected for such study represent various situations of increasing or declining job opportunities in Philadelphia.

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Vom Saal, Rudolf E., Agent, Travelers Insurance Company, 100 East 42nd Street, New York City
Walker, Dr. Mabel L., Executive Secretary, Tax Policy League, 309 East 34th Street, New York City
Woodbury, Perry S., Statistician, Vick Chemical Company, 122 East 42nd Street, New York City

NOMINATING COMMITTEE

In accordance with the provisions of the Constitution, President W. Randolph Burgess has appointed a Nominating Committee to make nominations for officers to be elected at the next Annual Meeting. The members of the Committee are Edwin B. Wilson, Chairman, Winfield W. Riefler, and Willard L. Thorp.

FREDERICK F. STEPHAN, *Secretary*

REVIEWS

The Design of Experiments, by R. A. Fisher. Second edition, Edinburgh and London: Oliver and Boyd. 1937. xi, 260 pp. 12*s*. 6*d*.

This important monograph on scientific method now greets the eye with a jacket portraying in color a Latin square. Its interior differs little from the first edition except in the addition of an enumeration of 8×8 and 9×9 Graeco-Latin squares, a discussion of procedure when an observation is accidentally lost, and Tippett's treatment of the problem of a cotton mill in which one of the five spindles was found to be winding defective weft. In the last case, the cause of the defect was unknown, but its origin could be traced further by interchanging four component parts of the spindles. These parts were reassembled in 25 ways such that each of the five parts of any one type was used once and only once in combination with each of the five parts of each other type. The reconstructed spindles were tested, five at a time, over five periods, so that each component was used equally during each period. It is shown how from the results the defective part was detected.

The volume is far too closely packed with ideas to be summarized. A few of the most striking portions may be mentioned. The discussion of the nature of inductive inference in the first chapter is supplemented in the next by the case of the lady who thought she could tell by tasting the tea whether the milk was put in first or last. The ramifications of the simple problem of finding out whether she was suffering from an illusion provide an appropriate epitome of the problems of experimentation in general. The meaning of tests of significance and of null hypotheses, and the necessity of randomization, are here clearly explained. A historic experiment of Darwin's is described in the next chapter, where Galton's faulty statistical treatment of the results is corrected. This example serves also as a defense for the assumption of an underlying normal distribution through a calculation showing the trivial difference arising from an abandonment of this assumption.

Agricultural experiments on crop yields, which provide the starting point and illustrations for much of the author's discussion, are introduced in Chapter IV and elaborated in the next chapter in connection with the Latin square. The fundamental problems here are to obtain a valid and reliable estimate of the errors, chiefly due to soil heterogeneity, and to minimize these errors. The Latin square is an arrangement of the treatments of the plots in such a way that no treatment occurs twice in the same row or the same column. One of the many possible Latin squares is chosen with the help of gambling apparatus, which is always necessary in Fisher's schemes in order to assure validity. The systematic squares sometimes used, in order to diminish the errors by distributing the repetitions of each treatment more widely over the field than by chance, are shown to be really inferior to chance arrangements because of the impossibility of obtaining accurate and unbiased standard errors. This brings out a most interesting point. Repetition

of an experiment, which is often thought of chiefly as a means of diminishing the errors by averaging, has actually a more essential function in the determination of the variance of the errors through the contrasts among the results of the repetitions. There is no use in diminishing the errors of an experiment by methods which preclude their measurement. Graeco-Latin squares provide a means of testing several questions simultaneously; for example, on the same land and simultaneously, it is possible without loss of accuracy as compared with separate experiments and with various incidental gains besides economy, to test not only the effects of varying fertilizer on the yield of beets but also the effects of methods of cultivation, of varieties of beets, and perhaps of other causes. To the wide possibilities of utilizing a single experiment with a limited budget to test simultaneously an increased number of questions, Chapter VI, on "the factorial design in experiment," is devoted. An ingenious variation of this idea, termed "confounding," is introduced in the next two chapters. Some exercises for the reader have been inserted here. It should perhaps be emphasized further that although factorial designs do not involve loss of accuracy in the mean values measured, as compared with simple experiments when accuracy is expressed in terms of theoretical variance, they nevertheless leave fewer degrees of freedom available for the estimation of error and thus reduce the effective accuracy of the experiment with respect to any one controllable variable. Where the number of degrees of freedom for error is ample, as it frequently is, this objection has of course little force; but for some situations it may become important.

Chapter IX deals with the increase of precision by concomitant measurements. If pigs are fed on various rations, the initial weight of each pig needs to be considered along with the final weight in judging the effectiveness of the ration. The correction to the final weight might be by mere subtraction of the initial weight, or by division by it, or by subtraction of some multiple of the initial weight. The most appropriate multiplier appears in general to be that determined by least squares. A new section in this chapter shows how to proceed when an originally balanced experiment is disturbed by the accidental loss of an experimental animal, plot, or other unit, or of two or more such units.

The underlying principle on which this correction depends may be expressed in the language of least squares, as follows. After carrying through a least-squares solution, suppose that we insert a new observation equation that is satisfied exactly by the values already determined for the unknowns. Then the new normal equations, though not identical with the old, will have the same solutions. The sum of squares of residuals will be the same as before and will have the same number of degrees of freedom as before, i.e., one less degree of freedom than if the new observation had been determined independently of the others. To apply this to a yield experiment on plots arranged in rows and columns, we observe that the unknowns in the corresponding least-square problem are the mean yields for the various rows and columns; and that filling in the yield for a missing plot in the manner prescribed minimizes the sum of squares of residuals.

Chapter X deals with the generalization of null hypotheses and fiducial probability. The concept of upper and lower fiducial limits for an unknown quantity is here elaborated. The eleventh and final chapter treats of the problems of estimation in those more complicated cases in which the estimates to be used are not linear functions of the observations and of the accuracy and amount of information involved. Examples deal with dilution problems in counting microorganisms, determination of toxicity of a drug by the mortality of experimental animals to which it is administered, and linkage of genes.

The economic statistician may at first doubt that this book contains anything for him, since economic problems receive only a brief mention. A closer reading will upon reflection reveal many subtle sidelights on the problems of economic and social statistics. One effect, for example, should be to deflate the idea that by maintaining 48 different state governments we are conducting an experiment likely to give valuable information regarding the relative values of their divergent laws. To make such an experiment strictly valid we should have to distribute the laws to the various states by drawing shuffled cards or some other process independent of their respective needs and desires. Its accuracy could be improved by arranging them in eight geographical blocks of six states each, assigning the laws at random within each block, if the number of different alternative statutes to be compared is six. The randomization could be further restricted with gains in accuracy, by cross-classification according to relevant variables, following the principles of the Graeco-Latin square. Further accuracy could be obtained by treating various historical features as concomitant measurements and making allowance for them by least squares in judging the results. If all this seems grotesque, it will serve to illustrate the nature of the qualitative difference between mere statistical observations and the self-contained experiment which Professor Fisher sets up as the ideal. Yet it will never be possible to dispense with knowledge obtained from mere observation without control or randomization of fundamental conditions. Indeed, the social sciences are in no hopeless condition because of the rarity with which self-contained experiments can be carried out. They have excellent company in this respect in astronomy and meteorology, which are respectable sciences in spite of the impossibility of direct experimentation in their domains.

HAROLD HOTELLING

Columbia University

A First Course in Statistical Method, by G. Irving Gavett. New York: McGraw-Hill Book Company, Inc. Second Edition. 1937. ix, 400 pp. $3.50.

The author of this text is a mathematician, and his book is the outgrowth of twenty years' experience teaching a foundation course in statistics to students in the natural and social sciences, his course to be followed by more specialized ones in the various departments. The book was first published in

1925 and now appears in a second edition differing little from the original except for the addition of a chapter on multiple and partial correlation and, as the author says, the simplification of methods of deriving some of the formulas. Inasmuch, however, as the present reviewer has not previously reviewed the book, it will be considered as a whole in what follows and not merely in terms of second edition changes.

The author being a mathematician, his book is written as a mathematician would do it, and it is possible that its adoption as a text will be restricted mainly to places where the beginning course is taught by persons who are primarily mathematicians. For it is a fact, whether desirable or otherwise, that many of the existing texts on elementary statistics have been written just to avoid the thing which the mathematician always does—and is equipped to do so well. That is, the mathematician expresses himself in his symbolic language, he starts in general with a definition or an axiom and from this derives his results—formulas or whatever they be. All of which remarks are intended to call attention to and to comment upon a wide difference in purpose, in the extreme cases at least, between textbooks now available for beginning students in statistics: Those by the mathematicians with their emphasis on definition, on derivation, on symbolic notation and the like; and those which have deliberately attempted to avoid the rigors of the mathematician and yet to make his tools available to the uninitiated. The last quarter century has seen an enormous growth of interest in courses in statistics. Where twenty-five years ago such courses were hard to find, today they are numbered literally by the hundreds, and small indeed is the college or university which doesn't have at least three or four courses in statistics in different social science or other departments. This development of academic interest has of course paralleled a growth in the use of statistical methods in business, in public administration, and in research in the broad field of education. But like any new tool which has been suddenly and widely adopted, this one has been subjected to great abuse. The statistical machine has ground out tabulations, graphs, averages, correlations, and the like in great quantities, and the results have been duly added to our "store" of knowledge. One may suspect that the business man has been somewhat canny of this output in his own field, for he pays rather quickly and dearly for his mistakes; but there is no such avenging angel to check up at once upon academic output. When the degree has been awarded, or the article published or the promotion obtained, the researcher can well allow his "contribution" to be filed on dusty book shelves until another "researcher" is faced with the necessity of further extending the boundaries of human knowledge, whether through the pressures of the promotion system or from a pure love of truth for its own sake. All of which is a lengthy but necessary way of saying that there was something fundamentally wrong with the non-mathematical approach to the study of statistical methods; that the tools without the rigor and without an essential understanding of the conditions and limitations of their valid application were dangerous implements in the hands that wielded them.

One may gather from the above remarks that the present reviewer is sympathetic with textbooks in statistics written by mathematicians, and it may be said at once that the text under review is a very good one. Such comments as are made below mainly involve minor items or matters of emphasis. The subject matter that is presented in the book is probably more extensive than can be covered in most beginning courses in statistics, and it has involved very brief treatment of many topics that deserve longer consideration. The classroom teacher can, of course, limit himself to part of the book and can supplement the treatment therein contained—if his own knowledge of the subject goes beyond the book. One essentially good feature of the book is that what it does contain is good statistics. The reviewer, reading from cover to cover and prepared to note things that are definitely wrong, finishes his task with nothing recorded on such a list. What the book contains is good, it is written in a clear readable style, and it is generally systematically arranged.

One question of systematic presentation arises with respect to graphics. The main discussion is in Chapter Three, but Chapter Eleven, near the end of the book, is devoted to logarithmic graphic representation. Would it not have been better to combine the two chapters and to treat the whole subject matter of graphics at one time?

The author introduces one slight change of usage, in connection with graphs of frequency distributions, which seems unfortunate. He uses the term "histogram" to apply generally to all graphs of frequency distributions, referring to the separate graphs as rectangular histograms, frequency polygons, and frequency curves. The reviewer believes it is correct that Pearson applied the term *histogram* only to the rectangular type of graph (see Yule: Introduction, p. 84). This is a minor matter, but it raises the question of the desirability of standardizing notation and terminology over the whole field—the task that has been so well done in actuarial science and which serious students (beginners) so frequently wish could be done for statistics.

The author claims in his preface to have given the "only absolutely correct definitions of median, quartiles, and other division points in print, that provide a logical derivation of a simple formula for determining them." This claim is too sweeping. In the first place, his definition, as he himself admits, involves the hypothesis of uniform distribution of items over the class interval that includes the median, and this hypothesis may not be "absolutely correct." The reviewer would prefer to defend the statement that the only absolutely correct definition of the median requires the hypothesis of a frequency function to represent the universe and that the true median is the value of that abscissa the ordinate of which divides the area under the curve into two equal parts. There is no other *absolutely correct* definition. The median of a sample may therefore well be indeterminate within certain limits. In the second place, the author's special solution of this problem is hardly the first to appear in print. It is all there (described though not given

in formula form) in Zizek: *Statistical Averages*, p. 209 (Persons' translation), and the same formula as that used by the author is given in Chaddock. The reviewer has used and taught the identical procedure for twenty years.

There are a few places in the text where the author might well have gone further in simplifying calculation procedures. For instance, Yule's method of calculating the average deviation from observations grouped in a frequency distribution can very easily be presented in the form of a formula, and it is a great improvement over calculating deviations from the actual mean; and Kelley's formula for the average deviation from ungrouped observations deserves a place in any text.

The review of this text offers an opportunity for one final comment which the reviewer believes deserves to be made with respect to nearly every (if not every) elementary statistics text on the market. It is that the logical implications of statistical processes are largely absent from the texts and that beginning students therefore never come to appreciate this aspect of statistical methods. The answer that is almost sure to be made to this objection is that beginning students aren't mature enough to deal with such problems in logic and that therefore the most that can be expected is that they will gain proficiency in manipulation procedures. But this answer cannot be accepted. To illustrate, the traditional method of teaching averages says a few words about averages as type values and may even devote a few sentences to homogeneity of data from which the average is calculated, may even say something about random variation; but these worth-while starts are shortly forgotten, and, in choosing between averages in a given concrete situation, attention is almost wholly concentrated on such things as: (1) easy to calculate, (2) easy to understand, (3) effect of large or small values on the average. The present writer goes so far as to say that, in a problem of the scientific use of an average (and what other use justifies writing a text), the questions of understandability and ease of calculation deserve no consideration at all whenever such consideration involves compromise with other *scientific* characteristics of an average. See, for instance, the emphasis placed upon understandability and ease of calculation by Yule (by implication at least) and by Mitchell: U. S. Bureau of Labor Statistics Bulletin No. 284 (by explicit statement and by repeated emphasis). Is there more reason that the public consumers of averages should understand all their technical characteristics than that the public which drives automobiles should be technical engineers? Isn't it more important that the makers of averages should know how to make them properly, how then to interpret them, and should therefore place in the hands of the public only averages that are adapted to the use to which they will be put?

Professor Gavett, in common with other authors of statistics texts, it seems to me, does not put sufficient emphasis on this feature of textbook writing. He devotes, for instance, just one page to the discussion of the advantages and disadvantages of the several averages. I would have used at least half the chapter for this all important task. He subjects himself to mis-

understanding by a statement that the median is less affected by accidental variations than the arithmetic mean, a statement that can be found in essentially these terms in almost every elementary statistics text and which has been the cause of untold difficulties in teaching the scientific features of an average. How, for instance, square the above statement with the well-known fact that the sampling variation of the median is in general greater than that of the arithmetic average; and in a normally distributed universe is twenty-five per cent greater.

The reviewer hopes that the author will not take the above remarks as an unqualified condemnation of a text that he thinks has real high quality. The remarks are intended rather to express the hope that the texts (and the revisions) of the future will soon begin to emphasize an aspect of formal statistical methods that to date has been largely neglected and that must be made an integral part of our teaching of statistics if the subject is ever to attain the position as a scientific technique that it deserves.

BRUCE D. MUDGETT

University of Minnesota

Statistical Methods in Biology, Medicine and Psychology, by C. B. Davenport and Merle P. Ekas. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Fourth Edition. 1936. xii, 216 pp. $2.75.

The fourth edition of *Statistical Methods* by Davenport and Ekas has been changed materially from the preceding edition. These changes involve in particular new chapters in connection with the descriptive matter, as well as basic changes in the content of the statistical tables. The first three chapters on variation and measurement, seriation and plotting of data, and the classes of frequency polygons, remain essentially unchanged. Appropriate examples, as aids of computation, are introduced throughout the text. The remaining chapters in the new edition are largely new material on the Analysis of Variance, Correlated Variability and Measures of Relationship, Heredity, and Special Topics. Throughout all of these chapters, examples of computation have been introduced in order to permit the student, unfamiliar with statistical technique, to obtain a working knowledge of statistics. Owing to the condensed nature of the book, there is little space for text other than the presentation of equations and the computative examples which accompany each particular statistical technique. Consequently, the book can by no means be considered a textbook for the beginner in statistics.

The selected reference list of periodicals, published tables, and literature, has been shortened and completely revised in the fourth edition. The list consists of references to statistical technique and methodology, rather than a bibliography of source data, which was attempted in the earlier editions.

The tables are, on the whole, more practical in this edition. Table 1 involves an extensive list of statistical formulae. The logarithm table and that of sines, cosines, tangents, and cotangents, which occupy approximately one-

third of the previous volume, have been completely omitted. This space saving has been taken up to a certain degree by tables dealing with statistical significance, i.e., chi square, degrees of freedom for mean variance between samples, probable error, $1-r^2$ and the square root of $1-r^2$.

Much could still be done to make these tables more readable by separating the printed tabular material by spaces or lines. The tables as a whole, however, are definitely better set up than in the previous volumes.

The new edition of this book is the same size as the old. Unfortunately, it is bound in stiff-backed leather and consequently cannot be carried in the pocket with quite the ease as the third edition.

HALBERT L. DUNN

Bureau of the Census
U. S. Department of Commerce

Interpolation and Allied Tables, reprinted from the Nautical Almanac for 1937. London. Published by His Majesty's Stationery Office. Pp. 839–941. 1 shilling. (Obtainable from the British Library of Information, 270 Madison Avenue, New York, 35 cents.)

Due appreciation of these tables would constitute a review as long as the tables themselves. In spite of the increasing popularity of Aitken's processes, interpolation by differences will hold its place in many lines of work, and it is a pleasure to see a real contribution to the art. The Bessel and Everett formulas are considered by Dr. L. J. Comrie to be the best for nearly all purposes, and it is these that are abundantly tabled and illustrated. In some tables, the coefficients themselves proceed uniformly; in others, as is more usual, the phase n proceeds uniformly. Table XX shows the first three Lagrange coefficients with first differences, n proceeding by steps of 0.01. The Bessel, Everett, and Lagrange formulas are written out repeatedly in convenient locations, arranged in several different ways for accommodating different styles of tables and varying requirements of accuracy.

The pamphlet is much more than just another table of coefficients. Full facilities are provided for use of the "throw-back," a device that has been thoroughly tried out at H. M. Nautical Almanac Office and pronounced a great time saver when applicable. It consists of replacing the variable coefficient of fourth differences by a constant multiple of the coefficient of second differences; in Bessel's formula, B^{iv} is replaced by $-0.184\ B''$, whereupon the modified second difference $M'' = \Delta'' - 0.184\Delta^{iv}$ used in place of Δ'' permits the approximate accounting of fourth differences. Table XXII, though the columns are not clearly labeled, is a multiplication table for finding $0.184\ \Delta^{iv}$; and Table XXVI shows the error introduced in units of the fourth differences. This style of throw-back is applicable if the requirements in accuracy are not finer than 0.00046 times the fourth difference, and if fifth and higher differences are being neglected. In other circumstances, other styles of throw-back are possible, as noted on p. 927 and by Milne-Thomson in his *Calculus of Finite Differences*, pp. 71–72.

Another feature is the table of coefficients for computing derivatives from differences, and the formulas for computing differences in subdivided intervals. The explanation of the tables is not difficult to follow—even the details of machine calculation. A new procedure is illustrated for inverse interpolation by differences, the method having been in use in H. M. Nautical Almanac Office since 1934. H. M. Stationery Office is to be commended for reprinting these tables and making them available at a low price. The pamphlet comes with heavy paper cover, saddle stitched.

W. EDWARDS DEMING

Bureau of Chemistry and Soils
U. S. Department of Agriculture

Note added in proof. In a recent letter Mr. D. H. Sadler, now superintendent of His Majesty's Nautical Almanac Office, has informed me that in the expression for M^{iv} on page 929 the coefficient appearing as -0.28727 should be -0.27827. Some copies have been corrected, but not all.

W. E. D.

Gesundheitsstatistisches Auskunftsbuch für das deutsche Reich, by Kurt Pohlen. Berlin, Germany: Verlagsbuchhandlung von Richard Schoetz. Veröffentlichungen aus dem Gebiete der Medizinalverwaltung. 1936. xvi, 333 pp.

The unstable situation in Europe since the World War has caused European nations—Germany, Italy, and Russia in particular—to stress the importance to the national economy of a healthy and productive population. A natural outgrowth of this emphasis is the demand for more adequate information about the health of the population to serve as a basis for legislative and administrative programs. Dr. Pohlen has compiled an abstract which presents in a single volume a wealth of material on a great many phases of public health in the German Reich.

The abstract consists of a series of tables under eleven general headings, each dealing with a particular aspect of public health in Germany. Part I is a listing of the national and local health districts of the Reich. In order properly to evaluate the data contained in this compilation, it is necessary to recognize that private and public medical activities in Germany are as complex as the system of government. These activities have become more and more integrated and more immediately identified with the policy of the State. Some hint of this trend is given in the foreword by Dr. Reiter, president of the Reich Health Office, who says, "The National-Socialists have again awakened the consciousness in Germany that a rational and valid program for the development of the German people is indicated. The care of the health of the people should be the problem of every administration which, from a biological viewpoint, means developing that which promotes the health and productivity of the population . . . " The social insurance system in Germany has played a large part in the integrating process, and

this to some extent makes possible the collection of more detailed statistics than is usually the case in the United States.

Part II is concerned with the provisions for the maintenance of the health of the German people. These provisions fall into five divisions, the first of which deals with medical and nursing facilities. Hospital facilities are tabled in the second division and classified into private, public, and free public hospitals. Data are given for each type of hospital by bed-capacity groups, functional classes, such as tuberculosis hospitals, and by diagnostic groupings. Several of the tables in this part have a misprint in the title. The data given are for 1932, whereas the main title presents them for 1923. The third section of Part II is devoted to the pharmaceutical resources of the Reich, and the fourth section to statistics of the social insurance system. The fourth section is of particular interest in that it shows the very large part which social insurance plays in public health in Germany. There does not appear to be given, however, a figure for the total number of insured, although the number covered by each type of insurance is tabled. One hesitates, though, to total the tabled figures, since this addition might result in some individuals being counted twice. The last subheading under Part II sets forth the results of the activities of the public welfare organizations, such as the Red Cross.

Data on population and on changes in population are contained in Part III. Most of the figures are given through 1933. The population for the area of Germany in that year was approximately 66,000,000. The manner of growth of the population has not been uniform throughout the Empire. This is brought out by a chart showing the population at various times during the period from 1816 to 1933. The population of Germany tends to reflect, more or less clearly, the changes in the political situation. The marriage rate prior to the war remained fairly constant at a level of 8.0 marriages per 1,000 inhabitants per year. During the war, the rate fell to 4.0, but in 1920 it climbed again to 14.5, dropping off thereafter to the prewar level. In 1933, however, the rate reached 9.7, and in 1934, 11.2. This result again is probably an outgrowth of the policy of the State. In 1934 the birth rate was 18.0 per 1,000 inhabitants per year and the death rate, 10.9.

One is reminded by Part IV of Shakespeare's seven ages of man, for, with the exception of the first subheading dealing with the prenatal period, figures are given on the period of birth, infancy, the preschool period, the school period, the "productive" ages, and old age. It is difficult to separate the influence of the Government from the other influences bearing upon these statistics, particularly the data on births and population. In 1933, to cite one instance, the number of illegitimate children born in Germany was slightly more than 10 per cent of the total births. For the United States the data published in *Birth, Stillbirth and Infant Mortality Statistics* for that year yield 4 per cent as the figure for the ratio of illegitimate births to total births. How much of the rate for Germany is due to the Government's attitude toward illegitimacy, it is hard to say. Some of the difference between

the rate for the United States and that for Germany may, perhaps, be accounted for by better reporting in Germany. The section dealing with statistics of infancy contains a pie chart showing the nutritional status of infants in Prussia. Only 8.5 per cent of these infants are placed in the good nutrition group, the remaining 91.5 per cent being split about equally into the fair and poor classes. A statement on the method of collection of these data would not have been amiss. What age groups does the term "infant" include? Various anthropometric measurements are presented in the section on the development of the body in childhood and youth, and correlation tables are set up for certain of these measurements. This section should prove of particular interest to the child hygienist as well as the anthropologist. Some industrial morbidity statistics are presented in the section dealing with the "productive" ages. In this subheading, as in the one which follows on old age, the statistics are again linked with the administration of the social insurance system.

Marriage, divorce, and the congenital diseases form the theme of Part V under the general heading of Bases for Population Policy. Statistics on the marriage loans of the State are given in this section.

The infectious diseases are treated in Part VI. The subheadings on venereal diseases and on the activities of the organizations administering the venereal disease problem are of particular interest at the present time when public health authorities and the public in general are focusing their attention more sharply than ever on these diseases.

Cancer and diabetes are dealt with in the next section, which also contains tables on the mental diseases and alcoholism. As in this country, the death rate from cancer has been steadily increasing. In 1931 the rate for Germany was 137 per 100,000 population. It is not mentioned what forms of cancer are included in this rate. The figure for cancer and other tumors given in *Mortality Statistics for the United States* for 1931 was 109.9 per 100,000 population.

Part VIII contains tables showing the number of blind, deaf, and crippled, by age and by cause and type of infirmity.

Accident and suicide statistics are set forth in Part IX. Since the war years, which witnessed exceedingly low suicide rates in Germany, the incidence of suicide has steadily increased, and in 1932 a rate of 41.6 per 100,000 population was recorded. This contrasts with a rate of 17.4 per 100,000 population for the same year in this country. Part IX also contains a subheading on health conditions in the German army during the World War.

General Morbidity and Mortality Statistics is the title of the tenth section, which is subdivided into a section on various morbidity statistics, such as health indices, a section on life table functions, and a final section on the causes of death classified under the headings of the International List.

The cost of the various health services is set down in the last section. It is hardly necessary to stress the value of such information to an administrator. It is to be regretted, however, that some attempt was not made to

present the costs on a per capita basis. Such an arrangement would, perhaps, permit comparisons with other data which might not be made otherwise. This statement is particularly true as regards the costs of the various types of social insurance, which on a per capita basis would be of timely interest in this country because of the social security program.

The value of Dr. Pohlen's abstract, over and above the value it has as a source of information on various aspects of public health in Germany, lies in the fact that a bird's eye view is gained of the public health setup. By placing in a single volume data on various phases of public health, the interrelationship of the parts is more clearly brought into focus. Moreover, fruitful lines of inquiry may be perceived which might otherwise have been neglected. Many public health workers, feeling the need for some such compilation for their community as Dr. Pohlen presents for Germany, have kept notebooks for their personal use. The usefulness of the abstract would be enhanced if some statement were made at the beginning of each section on the source and method of collection of the material. Without such statements, there is danger of unwarranted comparisons being drawn and of valid comparisons being overlooked.

PAUL M. DENSEN

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De Bevolking van Amsterdam. Statistische Mededeelingen van het Bureau van Statistiek der Gemeente Amsterdam. Deel IV: Statistische studie over huwelijk, echtescheiding, geboorte, sterfte, vestiging en vertrek. Amsterdam. 1936. J. M. Meulenhoff. 206 pp. F 2.50.

An official publication issued by the statistical bureau of the municipality of Amsterdam, this book is concerned with the records of marriages, divorces, births, deaths, and migration into and out of the city. It is much better than such publications usually are because the editors have not confined themselves simply to presenting data but have taken pains to add extensive comment. As a result, the volume contains valuable information for the student of economics or sociology who is interested in the demography of a large European city.

The vital statistics of Amsterdam are kept with great accuracy. This condition is chiefly due to legal regulations and is equally true of all the European countries which have adopted the provisions of the *Code Napoleon* with regard to the *état civil* (control of registration). As a result of these provisions, all births, marriages, divorces, and deaths have to be recorded in registers kept by the municipal authorities. Even changes of residence have to be reported to the city hall. It is needless to say that, under such a system, vital statistics attain a much greater degree of accuracy than in the United States, for instance, where such strict legislation does not exist.

In the present volume, all the phenomena which are revealed by the vital statistics of the city of Amsterdam are thoroughly discussed by competent specialists. Tables, charts, and diagrams are used profusely to illustrate the

text. The figures for Amsterdam are compared with those of other cities at home and abroad and with those for the Netherlands as a whole.

One interesting feature is that different tables are given for the various religious denominations; for instance, the statistics show that the birth rate is the highest among the Roman Catholics and the lowest among the people who do not belong to any denomination. The same classes have, respectively, the lowest and the highest divorce rates. Besides separate figures according to religious creeds, an attempt is made also to give distinct tables for the different social classes.

RAYMOND DE ROOVER

Cambridge, Massachusetts

Prices in Recession and Recovery, A Survey of Recent Changes, by Frederick C. Mills. New York: National Bureau of Economic Research, Inc. Number 31. In cooperation with the Committee on Recent Economic Changes. 1936. xv, 581 pp. 60 tables, 16 charts. $4.00.

As the efforts to stabilize commodity prices multiply in volume and increase in importance, the urgency of understanding the nature of price changes and the structure of the price system becomes greater.

There is no doubt that the problems growing up in this field dominate a very large part of economic research at this time. The latest volume written by Professor Mills adds new and valuable data to the store of knowledge to which he has already contributed rich findings. The survey of price data through a peculiarly interesting period in American economic life cannot be ignored by any serious student in the field and will be of immense value to all those working on this type of problem.

The material contained in the book is many-sided and various. The chapter headings give some indication of the scope of the work, but, to gain a more exact impression, it would be necessary to consider the very suggestive subheadings to know the nature of the analysis. The first major division covers the pre-recession situation, recession and depression, and recovery. The angle of approach shifts then to take up in somewhat more detail the special aspects of the recovery of prices, including the fortunes of primary producers, manufacturing industries, manufactured goods and raw material, capital equipment, consumers' goods, and increasing productivity.

Some of the subdivisions listed in these divisions indicate the existence of those border-line cases, overlapping concepts, and insufficiently defined terms, making it difficult for the writer and the reader to classify commodities in a useful way. This difficulty, which is implicit in all work in the field, cannot at present be eliminated, and it accounts for some of the differences in treatment by different authors.

A long statistical appendix and many exhibits included in the text at various points give relatives and indices of such importance that they would have sufficed to justify the work involved without the interesting commentary and comparisons made by Professor Mills.

As in all controversial fields, there will be considerable query with respect to certain statements, and some differences in opinion on interpretation. There is occasionally an implication of symmetry of price movement and comparability of cycles which might be questioned. On page 14 there is a suggestion of homogeneity in the character of the goods and the types of fluctuations which, though not definitely stated, makes an impression some might challenge. As the statistics seem to show similarity in some cases, there is still room for question whether this similarity is not an accident growing out of the nature of the instruments of quantitative measurement, and not really a characteristic of economic fluctuation. Professor Mills shows that he is aware of the peculiarities of price conditions which often blur their meaning because quality cannot be brought out. Many of the relatives conceal significant differences of type or quantity which cannot be revealed by statistical processes.

Familiar and understandable devices are used to show the diversity of movement of various price relatives. The fan-like spreading apart of the prices of various commodities is used to illustrate the types of stress and strain to which the system is subject. It is clear, however, from this analysis, as from other studies, that it is not possible to judge when prices are moving together to establish a new norm and when they are fanning apart to exert an unhealthy pressure on economic systems. Only a careful survey of particular cases can make possible a diagnosis of the significance and causes related to these phenomena. Such a detailed analysis is not possible within the scope of such a study, nor could it be carried on in connection with all the various price relatives included here. Because of these practical limitations, it may be worth considering whether it is possible to make a different statistical approach to the question in order to avoid possible misinterpretation.

Many of the students who use this material will not have the breadth of knowledge possessed by the author and will not immediately recognize the dangers of assuming that base points have a universal significance. It is conceivable, for instance, that semilog curves presented for certain typical price relatives and extending over several cycles would serve to caution the reader and suggest to him the limited meaning of using any year as a norm. Although it is true that this type of curve is complicated and even confusing to some, it may be necessary to give perspective in certain cases.

Although the interpretation in the text is sound, it is possible that some of those using the material will jump to false conclusions. The complexities of price analyses are already appallingly great, and it is well to observe all the cautions and qualifications in the text which suggest the various types of factors. A careful reader is definitely made aware of the difference in maturity of the industries, in types of markets in which they are sold, and in the nature of professional speculation which bears on short-run price changes. Other complications hinted at here and there, and not always emphasized enough, grow out of the market prices, the influence of jobbing,

the mechanisms of commerce, and special contractual relations. These factors lead to a jerky and, at first sight, irrational response of prices to cost and to demand. Powerful influences of this nature may distort price relationships more at certain phases of cyclical fluctuations than at others.

The study of rebates, discounts, commissions, and other special arrangements, though not possible within the framework of this particular study, should be carried on by those who wish to bring together the theoretical and actual business experience in order to gain a complete picture of the situation.

The peculiar situations resulting from special recovery measures in 1932 and 1933 are sketched in the later sections of the book. No clear answer is given in the discussion, nor can it be given on the basis of price data, to the question regarding the effect of recent controls and special efforts on the speed of recovery. The footnote on page 307 gives guarded acquiescence to the idea held in many quarters that the turn toward recovery in 1932 gives a point of reference which marks a new phase in the cycle. The discussion on page 458 of "points of diffusion" is very suggestive and enlightening.

It must be admitted that no short review can do justice either to the value of the material or to the diversity of ideas in the study. It may well be that we have reached a point where emphasis must shift back toward the more classical type of analysis, now that we have available an abundance of data from all types of industry representing practically every variety of commodity and fairly representative of the country as a whole. If more quantitative data are needed, they should perhaps come in such a way as to throw light on regional differences. We must devote further effort to sharpening our concepts and sorting out the more important theories from the mass of ideas which are now available in print and elsewhere. Professor Mills has done a real service in giving us not only a new store of facts but also in putting his ideas and interpretations before us.

ELEANOR LANSING DULLES

Social Security Board

Migration and Economic Opportunity: The Report of the Study of Population Redistribution, by Carter Goodrich, Bushrod W. Allin, C. Warren Thornthwaite, Hermann K. Brunck, Frederick G. Tryon, Daniel B. Creamer, Rupert B. Vance, Marion Hayes, and others. Philadelphia: University of Pennsylvania Press. 1936. xvii, 763 pp. $5.00.

This book is the final report of the study of population redistribution, an investigation undertaken in 1934, under the auspices of the Wharton School of Finance and Commerce of the University of Pennsylvania, with funds supplied by The Rockefeller Foundation through the Social Science Research Council. The study sought to determine what internal movements of the population were necessary and desirable and what part the Government should take in directing them. Special portions of the study have been issued in four *Bulletins*.

The formal divisions of the book are as follows: a Preface; a very short Introduction; Part I, "The Need for Migration," consisting of eight chapters and occupying nearly 500 pages; Part II, "The Control of Migration," made up of four chapters; and four Appendixes, "The Analysis of Past Migration," "Wheat Production in Western Kansas," "The Location of Manufactures," and "Memorandum on the Selection of Manufacturing Areas for the Housing Program." Nine plates, 79 figures, and 79 tables are utilized to present the masses of factual data assembled in the study. The work includes an index, but a very inadequate one. It does not give names of the authors and books referred to, an omission made more serious by the failure to include a bibliography with the study.

The book centers attention upon the problems, "Where should the people be? And how can they get there?" The first chapter is an abortive attempt at indexing and correlating levels of living and migration, an attempt in which an income tax-telephone-radio index was used with all seriousness in an attempt to gauge fluctuations in the national plane of living, and in which the percentage change in population was used as a measure of migration. Then the book develops into a mosaic of excellent treatises by the various specialists. Thorough expositions are given concerning the special problems of the Appalachian Coal Plateaus, the Old Cotton Belt, and the Great Plains. Detailed analyses are presented showing the changing distribution of resources, the changing pattern of industrial location, and the changing demand for manpower. An exception to the general excellence of the study is the very inadequate summary of the record of unguided migration. This, however, is followed by concise and informative summaries of experience in controlling migration in Russia, Germany, and England. A critique of American measures is confined mostly to New Deal experiences but is fairly adequate on that score. The final chapter, "Toward a Migration Policy," indicates the unsatisfactory nature of the information about migration and how inadequate are the data concerning the problem. Further research and particularly the inclusion in the Census of a question dealing with migration are the principal recommendations.

Probably through the efforts of Rupert Vance, the report recognizes that disproportionate shares of the burden and cost of rearing future generations of Americans are falling upon the South and other poor rural areas and that the inadequate resources of these sections are reflected in the quality of the migrants who go to replenish the populations of urban areas. It recommends equalizing the burdens of rearing and educating the children of the nation, although no definite measures for attaining this objective are specified.

The authors are to be congratulated for successfully overcoming many of the difficulties in the way of coordinated research. It is true that the technical training of some of the writers occasionally leads to minute considerations of insignificant details, a procedure which tends to obscure the broader perspective of the study. A better utilization of the entire literature on mi-

gration might have been secured had one of the rural economists or sociologists from the Agricultural Experiment Stations participated in the study, for they are the group who have contributed most to the study of rural-urban and farm-to-farm migration in the United States. Nevertheless, the work as a whole stands as the most valuable contribution yet made towards an integrated national policy relating to migration.

T. LYNN SMITH

Louisiana State University

Three Years of the Agricultural Adjustment Administration, by Edwin G. Nourse, Joseph S. Davis, and John D. Black. Washington, D. C.: The Brookings Institution. Publication No. 73. 1937. xiv, 600 pp. $3.50.

This is the seventh and concluding volume in a series of current studies of the agricultural adjustment program undertaken in 1933 under the auspices of The Brookings Institution. The preceding volumes are specific studies of the A.A.A. program with respect to marketing agreements, wheat, the dairy industry, tobacco, livestock, and cotton. This final volume is an attempt to summarize and appraise the program as a whole. It is interesting both as the most comprehensive treatment of that subject thus far available and as an experiment in current interpretation of a large-scale contemporary program. The prominence and recognized ability of all three of the authors make the undertaking especially valuable.

The study must be judged with respect to its success in measuring the effects of the forces brought into play by the A.A.A. program and as a study in economic and social philosophy. Neither task could be so handled as not to afford abundant grounds for disagreement on the part of many readers. In the more definitely economic phases of the analysis, some critics will find the treatment over-simplified and too strictly Marshallian in type. This reviewer feels, however, that it reflects with reasonable accuracy the general nature and magnitudes of the effects, except in a few instances which for lack of space cannot be discussed here. The appraisal in terms of basic philosophy and the conclusions drawn seem less satisfying and not always entirely consistent with the findings of fact earlier discussed.

The make-up of the book is as follows: first, a brief historical sketch concerning agricultural adjustment as national policy. This is followed by chapters dealing with the adjustment act, administrative setup, programs, production control, commodity loans, purchase and diversion, marketing agreements, administrative problems, effects on various groups, and contributions to recovery. There follow a section on A.A.A. philosophy reconsidered and supplementary discussions by J. S. Davis and J. D. Black bringing out certain divergencies in points of view. Appendix A, by H. B. Rowe, provides much of the qualitative analysis on which the conclusions as to fact were based.

Certain general conclusions concerning the book seem to this reviewer to be warranted. First, the factual presentation, though inevitably open to

challenge at many points, is by far the best available to date. Second, the book seems less satisfying than the best writing these authors have done elsewhere. Third, the discussion of philosophy and basic objectives lacks the depth and scale which might have been expected of these writers. One wonders whether there may have been too many other demands on their time and a too close-up view to permit an appraisal that will stand the test of time. Possibly also there would have been advantages in separating into two different studies the analysis of the mechanics of the program and the study of basic policy considerations.

Space permits only brief mention of major conclusions. Some of the most important of these have to do with the effectiveness of the program. In general, the authors feel that other factors in the situation had much more to do with the reductions in output than did the A.A.A. reduction programs, except in cotton and tobacco. The authors agree, however, that in another set of circumstances the control devices would probably have had more influence, though they also doubt that such influence could have been maintained for an indefinite time. For example, they say, "all in all, we consider it quite improbable that the A.A.A. could have achieved without resort to coercive measures a net reduction of the wheat crop averaging over 160 million bushels a year, if as much. Such a reduction would have left production averaging at least 700 million bushels a year, or well in excess of ordinary domestic requirements, thus making reduction of excess carryovers dependent on a dubious development of export outlets or extraordinary diversion operations." Likewise in the matter of corn reduction, they state, "had normal weather conditions prevailed in both 1934 and 1935, the A.A.A. with the same programs or ones calling for more drastic curtailment, would have had a much greater influence on production. Conceivably the outturn might have been held down to 80 or 85 per cent of what it would otherwise have been, and a net reduction of 300 to 400 million bushels obtained each year. Under these circumstances, however, production in the two years would have been much larger than it was."

"Our general conclusion from the experience with production control in 1933 to 1935, so far as we can observe it through the dust of the drought, is that the effectiveness of these devices is such as to make them practical in emergency periods. . . . The experience does not, however, give support to the belief that similar control could be made practicable as a means of holding the course of production over the years close to a line laid out in accordance with a continuously operating economic plan." (J. D. Black dissents from this view as regards long-run effectiveness.)

The purchase and diversion activities have been more extensive and on the whole more successful than most people have realized. They have, however, been carried on too largely from the standpoint of raising agricultural prices, rather than of most effective handling of the commodities in the national interest.

The attitude toward commodity loans of the type used by the A.A.A. is

one of skepticism, although the authors feel these may have a place in certain emergency situations.

The marketing agreement type of control is regarded as by no means perfected but of sufficient promise to warrant continuance for certain specialized producing territories, if improved and more adequately safeguarded from abuse. For milk marketing, however, this seems not to be an adequate mechanism.

Appraisal of the financial effect on farmers indicates gains of 1.8 to 2 billion dollars for the period, offset by some 10 to 25 per cent, which represents increased costs to farmers as consumers. The total cost of the program to the Federal Treasury was put at around 900 million dollars exclusive of the 900 million dollars collected in processing taxes. The estimated cost to the Treasury includes 100 million dollars loss to it through the ½ cent per pound reduction in import duty on sugar.

The authors conclude that "the recovery argument was sound in the sense that the effect of agricultural adjustment programs has been on the whole on the positive rather than the negative side. . . . The experience discredited those who believed that agricultural relief could bring about complete general recovery." In discussing the relationship of the program to planning activities, the authors feel that "the program seems on the whole to take on more definitely the character of financial aid for everybody and less that of specific implementation for a planned system of efficient farming. . . . If real planning is to be forwarded, these barriers (intrenched special interests) will have to be broken down, and it will have to be demonstrated that the A.A.A. can take steps which give better organization, higher efficiency, and lower cost to the nation's agriculture as a whole, even in circumstances which are to the clear disadvantage of whole states or even sections, at least in the immediate situation."

This reviewer does not agree with some that the divergent views expressed particularly by Black and Davis have vitiated the book. They have rather pointed the way to further explorations needed especially as regards the bases from which the different authors reason. Black apparently stands nearer to Wallace and Tolley in thinking of a rather aggressive, continuous planning program oriented pretty much to farmers' wishes. Davis seems to look upon the procedures more largely as methods of meeting emergencies, "the fire department" or "War Department" setup. Nourse's views in these connections do not appear very definitely.

A serious lack in the present volume lies in the fact that the matter has been discussed almost wholly as an agricultural problem rather than as a national problem. This is one of the surprising features of the book, in view of the acknowledged stature of its authors. Some of the most stimulating concepts presented with respect to a national outlook are to be found in the supplemental statements by Davis and Black; for example, Davis' comment on page 481, that the Department of Agriculture should devise and mature provisional programs somewhat as the War Department does, is

one that deserves fuller development, although possibly not in this particular book. Black's supplement also opens up some very fruitful lines of thought, though, in the opinion of this reviewer, the first part of that section is inadequate. Most of his later points are well taken and thought-provoking.

Several aspects of the program seem to be dealt with in a less penetrating way than might have been expected. This statement is particularly true of such sections as the one pertaining to large payments to given growers and the one pertaining to the effects on the poorer classes of laborers and tenants. The first of these is dealt with even less frankly than in the Senate's request and report dealing with this subject. The real challenge in this situation was not whether anyone had been reprehensible in claiming or giving large payments but whether the basic plan itself was so designed as to make suitable classifications among recipients of benefits. To class payments as not large if under $10,000 is, to say the least, accepting rather undiscriminatingly the less-than-frank official treatment of this matter.

One is surprised at occasional statements which seem either unduly defensive or inadequately investigated; for example, "in general, however, outside the South no major criticism of the landlord-tenant phase of the A.A.A. program arose." The authors comment, "the A.A.A. was never conceived for the purpose of equalizing income or restoring freedom of initiative and equality of opportunity among different tenure classes within the farm population." Possibly this is true, but, if so, it would surely seem that the adequacy of its conception might well have been discussed more fully by these writers than was done.

One of the least satisfactorily handled sections is that on the Consumers' Counsel. There is no recognition of what has seemed to this reviewer the wholly unsuitable location both of the Consumers' Counsel in the A.A.A. and of the Consumers' Advisory Board in the N.R.A. In fact, the authors go out of their way to commend this provision in the program. They state, "it must be said of the A.A.A. that it has made the beginning of an approach to the problem of agriculture from the standpoint of the consumers, and that it has kept the consumer more nearly in the picture than other agencies identified in name with a group or industry." It is difficult to justify such a statement when we consider the long records of agencies like the Interstate Commerce Commission, the Food and Drug Administration, and the Federal Trade Commission, by indirection at least designed for the protection of consumers. The conclusion that the Consumers' Counsel function should be to aid the Agricultural Adjustment Administration in analyzing the effects of these programs on the consumer seems well taken. Obviously it could not in its then existing relationship perform the kinds of functions which its early leadership had in mind. This statement does not alter the fact that in both A.A.A. and N.R.A. the consumer position was precisely that of an employee working under the benevolent despotism of a corporation which is willing to provide welfare workers to study his problem but

which has no intention of recognizing direct representation of his interests. For example, Black states, page 488, " . . . the continuing program conceived by A.A.A. officials is not one of reducing supplies to the point of raising prices to unreasonable levels for the producers of farm products, but instead one designed to hold production roughly near an equilibrium conceived *by it* (italics ours) as equitable as between agriculture and other classes. . . . " Most students close to the realities of the situation feel that the Agricultural Adjustment Administration has handled these powers with wisdom and moderation. This judgment, however, does not seem to alter the principle that, with its present setup, it is both special pleader and judge in the same case.

Appraisal of any current large-scale movement at such close range inevitably presents many difficulties. This book does not provide a final word on any of the matters dealt with. It does seem to this reviewer, however, to make very worth-while progress toward understanding the effects of the various phases of the A.A.A. program. It merits both study and critical analysis by every serious student of national policy.

M. R. BENEDICT

University of California

Explorations in Economics, Notes and Essays Contributed in Honor of F. W. Taussig. New York and London: McGraw-Hill Book Company, Inc. 1936, xii, 539 pp. $5.00.

This collection of "notes and short essays," by students and associates of Professor Taussig within the fields of economics in which he was particularly interested, was published in his honor on the occasion of his seventy-seventh birthday. The most that need be said in a short review notice is that it is a fitting monument to the occasion. The list of contributors is a sufficient memorial to Professor Taussig; it is certainly more impressive than could be a similar list for any other American, perhaps any other economist of the period covered by Professor Taussig's long active life. These names also speak for the character and value of the book itself. As the anonymous editors do well to remark, several features of Professor Taussig's work escape portrayal in such a volume. They refer to his important public activities and his great contribution to economics as editor of the "Quarterly Journal." The reviewer would underline the latter. It would hardly be an exaggeration to say that there is no worker in the field of economics who is not in a real and important sense a "student and associate" of Professor Taussig's. The present writer may take occasion to say that he got his own start in the serious study of economics from Taussig's "Principles," though not in Taussig's classes, and has always considered it easily first among American treatises and textbooks, considered as a book. On doctrinal positions he has of course found in it much with which to differ, as any economist does in any book, especially one covering so large a field.

The forty-eight contributions contained in the volume are published

under three sectional headings dealing, respectively, with the fields of international trade and tariff, general economic theory, and the social setting of economic activity. Each section is introduced by a critical essay on Professor Taussig's thought in the corresponding field. Subsequent essays treat independently of topics of special interest to their authors. The third section has proved of most interest to this reviewer, especially the introductory essay by Professor Talcott Parsons. Perhaps such symposium volumes are likely to find their chief value for brushing up on fields more or less apart from the reader's narrow specialty. The writer has never felt intensely excited about international trade theory, which seems to be rather a matter of pedagogy, and an obvious rather than a really special "case" under general economics. It goes without saying that Professor Viner's introductory essay is judicious and appropriate. This is obviously not the place to stir the fires of controversy, and the reviewer would have preferred to say nothing but what is entirely pleasant and optimistic. But conscience will not let him sign any reference to the book which leaves a reader free to infer that he would accept much if any of the economic doctrine expounded by Professor Schumpeter in his introduction to Part II (entitled "Wages and Capital").

FRANK H. KNIGHT

The University of Chicago

Bevölkerungswellen und Wechsellagen, by Dr. August Lösch. Jena: Verlag von Gustav Fischer. 1936. x, 124 pp. Rmk. 6.

Dr. Lösch, in this publication, the thirteenth of the series edited by Professor Arthur Spiethoff—Beiträge zur Erforschung der wirtschaftlichen Wechsellagen: Aufschwung, Krise, Stockung—does not pretend to present a complete theory of business cycles. He is perhaps more interested in population fluctuations as such than in industrial fluctuations. Yet he does seek to investigate the impact of population movements on business conditions.

He notes that many earlier writers have considered the relation of population growth to the business cycle. But these have usually restricted themselves to theoretical discussions. Factual data have been neglected. These he seeks to supply.

The author is convinced that fluctuations in the labor supply are not the result of the business cycle. These fluctuations, on the contrary, furnish, he thinks, an important part of the explanation of the cycle. The fluctuations in the labor supply emerge from periods of great distress—war, famine, pestilence. Of these, wars have the most important influence. A predicted curve, based on the assumed effect of the early Napoleonic wars and of the "War of Liberation" upon the population of Prussia, is compared with the actual movements of population. These in turn are related to production curves. Fluctuations in the birth rate in Sweden since 1630, and in the various countries of northern Europe from 1816 until the World War, are considered. These are compared with changes in the labor supply 15 years

later. Comparison is made with crop fluctuations in Sweden and Germany and with price fluctuations in Sweden. The relation of crops, labor supply, marriage, and fertility rates to climatic changes and war are considered with special reference to Sweden.

The author argues that the growth of population acts as a stimulus tending to produce an upswing in business and that population decline tends to create depression. The growth of population expresses itself in an increased demand for consumption goods, for building construction, and for producers' goods.

That population movements and fluctuations in investment may act and re-act upon one another has long been recognized by business-cycle theories. The interrelation is, however, extremely complex. Dr. Lösch seeks to establish the thesis that population movements are causal factors influencing business conditions but not dependent upon business conditions. Having tried to establish that they are independent of business, he seeks to show that the population-wave movements correlate with business. Thus the conclusion is reached that the former is the cause of the latter. This reasoning is analogous to that of Moore with respect to the relation of rainfall to business. In both cases the statistical basis for the belief in the existence of cycles and their correlation with business is tenuous and uncertain. Moreover, in the case of population there is certainly some causal relation running the other way—from business fluctuations to population. There would be general agreement that both rainfall and population changes affect business conditions, but it is something quite different to argue that the business cycle is rigorously tied to a quite independently determined labor or population cycle.

ALVIN H. HANSEN

University of Minnesota

The Valuation of Property, A Treatise on the Appraisal of Property for Different Legal Purposes, by James C. Bonbright. New York: McGraw-Hill Book Company, Inc. First Edition. Published under the Auspices of the Columbia University Council for Research in the Social Sciences. Volume I, xx, 632 pp.; Volume II, xi, pp. 633–1271. $12.00 per set.

This monumental work is the first comprehensive study of the many ways in which the value of property is conceived and measured in American legal practice. Its purpose is not primarily to advance the theory of value or to suggest improvement in valuation technique but rather to indicate the relationships between various value problems and to offer a comprehensive summary of valuation practice. Incidentally, however, the critical analysis to which current value theory and appraisal techniques are submitted yields results which are well worth the consideration of experts in these fields.

The subject matter of this study is provided by several thousand court cases in which the valuation of property has been an issue in the litigation. In order to deal with these cases and to present an inclusive impression

of current thought on valuation it has been necessary for the author and his staff to survey a voluminous literature in the fields of economics, law, accounting, and appraisal. The different approaches of these various disciplines to the value problem are skillfully handled and, although on matter of detail their respective practitioners might object to Professor Bonbright's interpretation, these objections are not likely to be serious.

Perhaps the leading generalization that can be made of this work is that it represents a functional as contrasted with a conceptual or verbal treatment of property valuation. Professor Bonbright's central theme is that the greatest difficulties in the valuation of property are connected with defining the meaning of value and that value can only be defined with reference to the purpose to be accomplished by the valuation. The value of a piece of property can be and, very probably should be, different for purposes of taxation than for purposes of condemnation. Its value for public purchase may be different from its "value" for purposes of rate regulation. In the interests of clarity the terms value and valuation perhaps should be abandoned for a set of terms which reflect these different purposes. This being impossible it is necessary to eschew the sterile verbalism enshrined in the familiar phrase "value is value" and to recognize explicitly the significance of purpose in valuation.

To do so, however, as Professor Bonbright recognizes, is merely to formulate correctly the value problem. The "purpose" of valuation is to be found in the realm of public policy, and, unless the social consequences of one meaning of value and one technique of appraisal can be distinguished from another, no great contribution can be made to "correct" valuation. "Under these circumstances, an intelligent choice of a basis of valuation demands a prevision of its social consequences, in quantitative terms, to which no scientific method gives easy command." The fact, of course, that there are grave difficulties in the way of determining what the value of property *should be* does not, in explaining why property is valued as it is, detract from the importance of recognizing that the purpose of the valuation, together with certain assumptions either implicit or explicit as to what the social consequences of given types of evaluation will be, have a decisive importance in determining the result.

Since the most serious difficulties in valuation are connected with defining the meaning of value, the author devoted Part I of the book to concepts of value. The center of economic interest has always been in the "causes" of value; in an examination of the "forces" which determine value in the market. For one interested in the question of "correct" valuation procedure, the center of interest would appear to be the social consequences of different value concepts and valuation procedures. Although Professor Bonbright is interested in both the causes and consequences, he directs his attention primarily to the questions "What is value, and how is it found?" The answers to these questions are given in the current opinions and practices of accountants, appraisers, and, particularly, lawyers and judges. In

the course of the discussion a distinction is made between four basic value concepts: "market value," "value to the owner," "warranted selling price," and "normal value," all of which play an important role in legal economics.

Having distinguished various value concepts, Professor Bonbright turns, in Part II, to a discussion of methods of valuation. Here the accent is upon the evidences of value, and he considers in turn the significance of actual sales prices, original cost, replacement cost, capitalized income, and capitalized earnings. The chapter on depreciation contains a good discussion of the various important concepts of depreciation and is particularly valuable for its treatment of the relation between the views of accountants and appraisers on the meaning and measure of depreciation. Parts I and II cover some 250 pages. The remainder of the two massive volumes is devoted to a consideration in detail of valuation for different legal purposes.

Professor Bonbright attributes the absence hitherto of a systematic treatment of legal valuation to the fact that the "cautious expert fights shy of a problem that involves law, economics, accountancy and commercial appraisal." The relevance to the problem of all these fields of interest certainly makes the task of a reviewer an unenviable one. It needs no very considerable prescience, however, to recognize in this book a notable contribution to legal and institutional economics.

EDWARD S. MASON

Harvard University

The Recovery Problem in the United States. Washington, D. C.: The Brookings Institution, The Institute of Economics, Publication No. 72. 1936. xiv, 709 pp. $4.00.

For the layman this book provides an intelligible discussion of the recovery problem, full of pertinent facts and simple explanations. To the economist it affords a useful summary of the course of events leading up to and carrying through the depression and also a source of estimates on several economic magnitudes of great importance. For the teacher it has possibilities of use as case material.

When political action assumes a leading role in the direction and organization of an economy, the wisdom of such action becomes crucial to the national well-being. And, if in such circumstances "crackpot" ideas on the "economy of abundance," "technological unemployment," and "purchasing power" are seriously considered in support of legislative measures, economists have an obligation to speak out. As long as the education of the public is left to politicians, journalists, lawyers, business men, and even some members of the academic profession without competence in this field, the country will be easy prey for the propaganda of pseudo-economists. In this setting the book is a noteworthy contribution to public education.

The production of this work was planned and directed by Harold G. Moulton; collaborating with him in the writing were Maurice Leven, Leo Pasvolsky, Charles O. Hardy, Malcolm Merriam, George Terborgh, Hugo

Bezdek, Jr., and Kathryn R. Wright. For such a cooperative enterprise the book possesses a high degree of unity and coherence. The treatment of the subject is divided into three parts: first, an outline of "the sweep of world events" leading up to and through the depression; second, a more detailed analysis of the "readjustments in the United States, 1929–36"; and third, an appraisal of the recovery program in this country to date together with recommendations for government policy. Relevant factual material is supplied in abundance to enable the reader to acquire background for the judgment of the issues involved, but theoretical argument is generally restricted to fundamentals which the layman can readily understand. Problems of economic reform are given attention only in so far as they are related to recovery.

Most economists would subscribe to all or nearly all of Moulton's recommendations: reestablishment of a balanced Federal budget; maintenance of a fixed gold price and stable foreign exchanges; extension of reciprocal trade agreements to encourage international trade; preservation of the "favorable" ratio of wage rates to prices and its future increase through price decreases to spread the benefits of technological progress; maintenance of the prevailing hours of work; elimination of industrial practices—private and public—which restrict output or prevent the increase of productive efficiency; shift of the emphasis in agricultural policy away from curtailment and toward expansion of production.

The favorableness of the existing ratio of wage rates to prices may, however, be questioned. It is true that the indexes of average productivity per labor hour and "product wage" (average hourly earnings divided by price index of finished products) in manufacturing have recently had closely corresponding movements and apparently stand at parity in relation to each other (charts on pp. 258, 261). But this appearance is misleading, since the reabsorption of the idle with a 15 per cent increase in employment would substantially reduce the average productivity per labor hour. This and the obvious fact that relatively high-priced factors tend to be economized constitute reasonable grounds for doubting that the present wage-price ratio is favorable to recovery and for suspecting that a continuation of the administration's high wage-rate policy may cause a large volume of permanent unemployment.

THEODORE O. YNTEMA

University of Chicago

Banking and the Business Cycle, A Study of the Great Depression in the United States, by C. A. Phillips, T. F. McManus, and R. W. Nelson. New York: The Macmillan Co. 1937. xiv, 274 pp. $2.50.

According to the authors, the chain of causation of the Great Depression ran somewhat as follows: Following the war, prices did not return to a "normal" level. They would probably have done so had it not been for the very large expansion of bank credit which led to a huge "investment in-

flation." This rapid expansion of bank credit was due primarily to the policies of the Federal Reserve Board. The large imports of gold during the war made it possible to erect a vast superstructure of bank credit upon the gold base. But had it not been for the actions of the Federal Reserve Board, through its open-market policy, in forcing additional reserves on the member banks in 1922, 1924, and 1927 the expansion would have been much less. Excess reserves drove the banks into the investment market, and bank credit poured in steadily rising volume into capital-goods industries, real estate, and the stock market. It was the hyper-elasticity of the Federal Reserve system that made it possible. It was a "central bank inflation."

The Board's great mistake was its attempt to stabilize the wholesale price level. "It is the writers' opinion that we witnessed from 1922 to 1929 the world's greatest laboratory experiment with a 'managed currency,' *within* the gold standard, involving stabilization of the price level. And, to repeat, the view is advanced that the greater part of our recent troubles was the outcome of that stabilization experiment" (p. 181). It was this policy that prevented the much-needed further decline in prices after 1923. It produced the "disequilibrium between saving and investment that constitutes the heart of the boom."

The purchase of investment securities by banks creates deposits just as surely as do commercial loans. Using their excess reserves to buy bonds the banks brought about a divergence between the natural and the market rates of interest. This heightened profit-making possibilities for entrepreneurs who undertook new capital expenditures. New bond issues appeared, and the purchase of them by the banks created still more purchasing power and upset the equilibrium between investment and saving. Prospective profits of entrepreneurs then became actual profits. The income of the public was increased, and the rate of increase of investment was accelerated. And so it went on until the *rate* of increase began to slacken.

Profits from stock market speculation (supported by bank credit) kept buying power at a high level even after business and construction activity began to decline. Then the stock market collapsed. This collapse gave a severe shock to general confidence and also resulted in a great loss of consumer buying power. "In this sense, the stock market crash may be considered the immediately generating cause of the ensuing depression" (p. 159). Had it not been for Federal Reserve expansion in 1927 the stock market would not have risen to such unprecedented heights. What the Federal Reserve system did was to prolong a boom which, otherwise, would probably have come to a natural end in 1927. The effects, naturally, would have been much less disastrous, and the collapse of the banking system probably avoided.

Once the depression was well under way liquidation and the restoration of an equilibrium would, possibly, have proceeded in an orderly manner had it not been for another blunder—the attempt to keep wages up. It is the

authors' belief that had this mistake not been made we should probably have escaped the terrors of 1932 and the New Deal.

Now, they believe, we are making another grave error by trying to spend our way back to prosperity. "By consuming more than we have produced we have succeeded only in digging our way deeper into depression; we have tried to recover from depression by spending our way out of it rather than adopting the alternative procedure—the one which has effected recovery from every past depression—of *saving* our way out of it" (p. 165). What we should have done was to bend our efforts toward a revival in the capital-goods industries. "Instead, all efforts were directed toward bolstering up consumption."

High wage rates do not constitute high purchasing power. Wage rates in many industries, especially the construction industries, must come down. "What is hoped to be accomplished by a reduction of wage rates is an increase of aggregate purchasing power" (p. 222). Otherwise we shall probably have a long period of high and continued unemployment, because business cannot give full employment at present wage rates. We need lower costs in capital-goods industries. "Here is a brief and conclusive answer to the whole question of the consequences of artificially maintained consumption—*With labor receiving a greater percentage share of the total social product than at any time in recent history, the result was widespread unemployment and stagnation.* The way out is *via* greater production, a larger total social product, and that necessarily follows upon a greater amount of saving being made *and* converted into investment goods" (pp. 166–167).

Price stabilization as a policy, they conclude, must be abandoned. What we need is control of the *total amount of credit.* The ideal aim of credit policy should be to *stabilize the rate of credit growth.* Credit growth should proceed at the same rate as the growth of population. This would result in a practically constant money supply, an approach to "neutral" money. Changes in velocity need not cause anxiety, for under these conditions there would not be great variations in velocity. A falling price level might result, but there is much to be said in favor of a slow decline in prices, when, because of technological improvements, production is increasing.

Finally, present government policies of financing the deficit by loading up the banks with bonds are bringing about another inflation of bank credit. We may have to repeat the experience of 1929–1933 if we continue on our present road.

The authors are to be congratulated for having written a book which attempts to tell what has been wrong with us for the past decade and to point out what is *still* wrong with us. The reviewer agrees with their emphasis upon monetary and banking factors in bringing about our troubles. Recognizing with Cassel that "the present crisis is, in fact, a crisis also for the entire theory of business cycles" (quoted on p. 3), they have made a valiant attempt to give us an explanation of the forces that have been at work.

They frankly admit that they have not tried to expound a new theory but to piece together an eclectic one gathered from many sources and the work of many others. Their indebtedness to B. M. Anderson, Jr., Hayek, and Keynes is freely admitted. They have tried to integrate theories that they believe have previously been regarded as conflicting—the monetary, the structural, and the equilibrium theories. Well written, well organized, logically expounded, and based upon wide reading and research, the contents of this book should receive wide attention. It contains much of real value.

I wonder, however, whether the authors have read Chapter XVIII (Economic Progress and Falling Prices) and Chapter XIX (Consequences of Various Forms of Price Stabilization) in Alvin H. Hansen's "Economic Stabilization in an Unbalanced World." If they have, I do not believe they have considered fully enough the dangers of a period of falling prices, so ably pointed out by Hansen. Also, what is the mechanism by which we can guide the growth of credit at the rate desired by the authors? Do we not need *qualitative* as well as *quantitative* control? The views of Hayek are now coming under increasing criticism, and Keynes has again changed his definitions so that now, he says, saving and investment are always equal.

Was the postwar price level really too high? Is it sufficient to compare the movement of prices in other postwar periods with this one? Had prices kept on steadily rising at the same rate as from 1900 to 1914, as they might have done had there been no war, the postwar level was not far above what might have been expected.

Are the authors on sound ground when they pay so little attention to international factors? Were the policies of the Federal Reserve Board responsible for the *world-wide* collapse? There is considerable room for doubt. Where did the depression first begin, and what was the chain of causation by which it spread from country to country? It is expecting too much of the authors to ask them to give us this information, I know, but it would help a lot to have it. Furthermore, it seems strange that a book coming out of Iowa should pay so little attention to the agricultural depression beginning in 1920 and the part it played in bringing on the collapse in 1929. Surely, it was a slip of the pen to write that the number of bank failures in 1931 "was greater than the total for *all* the years from 1900 to 1929" (p. 168). And did the stock market or did it not absorb bank credit?

I wonder if, before the authors begin to "universalize" their conclusions on the period from 1924 to 1932 to explain previous depressions, it might be desirable to make a similar study of those earlier depressions. It may be that we have had at least two types of cycles, that the long depressions of the forties, the seventies, and the nineties arose from somewhat different causes than those of 1884, 1907, and 1921. Why is it that our longest and most severe depressions have followed a period of relatively stable or slowly falling prices?

It is curious that Tugan-Baranowski, Spiethoff, and Schumpeter are not

mentioned in the volume. The reviewer would have been interested in what the authors think about Major Douglas and Social Credit.

The reviewer agrees with the authors in wishing that the depression could have been permitted to cure itself by the same remedies as were applied in the past, if only to see whether it could do so. But, for the first time in modern history, the majority of the people in most leading countries insisted that their governments should take steps to restore prosperity. That being true, it was politically impossible to let things alone. Governmental *spending*, therefore, became imperative. The government had to produce results. As much as we may dislike to see it, the world moves steadily closer to governmentally managed economic systems, for the rising power of trade unionism prevents wage decreases. Peoples demand economic security and expect the government to furnish it. And because things do not go in the way the government hopes for, the government tries to straighten out the mess by doing still more. It may, therefore, be a long, long time before another depression is permitted to cure itself. What kind of business-cycle theory will develop out of all this, it is yet too early to tell. But I suspect that a theory which would apply to an economic system based upon a high degree of individualism and competition will not be appropriate in the years immediately ahead. And the lot of the business forecaster will be an even unhappier one than it has been in the past.

CHARLES S. TIPPETTS

University of Pittsburgh

Public Finance, by Alfred G. Buehler. New York: McGraw-Hill Book Company, Inc. First Edition. 1936. xix, 632 pp. $4.00.

This college textbook is in the main arranged along lines that have apparently become standardized for public finance texts. Although chapters are not formally grouped, the customary order of introduction, expenditure, revenue, and debt is followed.

The book begins with a discussion of the nature and functions of the state and a description of the fiscal organization of governments. Seven chapters are devoted to expenditures, after which are placed two chapters on Federal and state and local enterprises, which are treated with respect to both their revenue and expenditure aspects. Fourteen chapters deal with taxation. Administrative revenues and special assessments are included in one of the chapters on taxation, no doubt for convenience as the location is not a logical one. Five chapters on borrowing conclude the book.

No group of chapters is devoted specifically to financial administration in contrast to recent practice in some texts. For an author to decide if and how financial administration should be discussed separately from the activities being administered is no doubt difficult. The solution of Professor Buehler is perhaps as happy as any. He presents a chapter on general administrative organization of finance early in the book and introduces at appropriate points other chapters and sections on the administration of

different financial activities. Perhaps unfortunately, the chapter on general administrative organization is mostly descriptive; it does not include an analysis of the functions to be performed and the problems to be solved by financial organization.

The emphasis throughout the book is on American conditions and problems although references to foreign practice are frequent. For the most part factual information has apparently been revised to about the middle of 1935, although in some cases the data are much more recent. In a few other cases less recent developments appear to have been overlooked.

Economic aspects of finance are considered somewhat more fully than is often the case in public finance texts. There are, for example, analyses of the relation of taxation to the business cycle (p. 494), of the economic aspects of unemployment relief (p. 127), and of the relation of borrowing to the distribution of wealth (p. 610). Subjects of recent interest such as control of governmental expenditures, conflicting Federal and state taxation, subventions and subsidies, the undistributed profits tax, taxes for old age pensions, and so on, are discussed.

Theoretical issues are in general well handled although there are exceptions. For example, taxes are said to be shiftable "only when they are imposed under conditions permitting a restriction of supply and a raising of prices" (p. 234). This limitation necessarily excludes backward shifting, which, however, is stated earlier to be one form of shifting (p. 230).

The style of writing is clear and simple. Words are used economically. Occasional sentences and paragraphs could, however, be improved.

The opinions of the author on public policy do not intrude to an unreasonable extent. Indeed, he appears to have been careful not to pass judgments unnecessarily. Such opinions as are expressed indicate a middle-of-the-road position.

This book is a substantial achievement and a welcome addition to the literature of the field.

ROY BLOUGH

University of Cincinnati

The Purchase of Common Stocks as Trust Investments, by C. Allison Scully. New York: The Macmillan Company. 1937. ix, 82 pp. $1.00.

In this excellent little book, Mr. Scully, a vice-president and trust officer of Bank of the Manhattan Company, New York, deals basically with the question of "whether a trustee is authorized and permitted to buy common stocks without being personally liable in case of loss." The book begins with a brief review of the development of trust concepts from the restrictions of feudal times to the more liberal views of the present day. The author finds that, contrary to popular belief, there is no rule of law holding that common stocks are not at any time or under any conditions a suitable investment for trust funds or that a trustee who buys them does so at his peril. As the best formulation of the rule he quotes from the Restatement of the Law of

Trusts by the American Law Institute, Tentative Draft No. 4, "the trustee is under a duty . . . to make such investments and only such investments as a prudent man would make of his own property having primarily in view the preservation of the trust estate and the amount and regularity of the income to be derived."

There follows a discussion of the possible adverse effects of devaluation and potential inflation on the purchasing power of income derived from the traditional fixed income trust investment instruments and on the real value of the corpus itself. He concludes that there is danger in this country of material loss to the beneficiaries of trust estates unless the trustees of these estates are able to diversify the trust investments so as to include the purchase of well-selected common stocks.

Provided common stocks fall within the definition of eligible investments, by terms of the will or deed and under the statutes of the state having jurisdiction of the trust, Mr. Scully believes that trustees may properly include among trust investment purchases those common stocks which meet certain tests of business judgment offered in the book.

The book will be useful to trustees generally. Though it is not the answer to a trust officer's prayer, it will lend him comfort until the answer comes.

CARROLL D. SIMMONS

The University of Texas

The Theory of Gold Supply, with Special Reference to the Problems of the Witwatersrand, by W. J. Busschau. New York: Oxford University Press. London: Humphry Milford. 1936. Oxford Studies in Economics. General Editors—D. H. Macgregor, G. D. H. Cole, J. Marshak. x, 193 pp. $3.75.

This volume is an application of economic, actuarial, and accounting theory to the gold-mining industry, covering such problems as the valuation of gold-mining properties, the determination of income from mining operations, the most profitable rate of exploitation of mineral resources, the determination of the grade of ore worked, and the taxation of mines. Although in general the principles set forth apply to all types of mining, the illustrations are drawn chiefly from the South African gold-mining industry, and the two chapters on taxation are written entirely in terms of the tax laws of South Africa.

The discussion is highly technical and very compact. In undertaking to review it I must confess that I have been content to take samples of the ore it contains and block out the content without attempting to exhaust the workings. These test borings indicate a high-grade deposit with long prospective life, a low risk factor, but high labor costs of exploitation.

A disappointing feature is the failure to discuss adequately the peculiar response of South African gold production to the stimulating factors which have been in operation since 1930. Between 1929 and 1935 the output of the South African mines rose by only about 3 per cent, though the production in Canada increased by 70 per cent, that of the United States by 50 per cent,

that of Russia by 450 per cent, and that of the world outside of South Africa by over 100 per cent.

The stability of South African production has been the resultant of a large increase in tonnage worked and a compensating fall in the average grade of the ore, a fall which was not at all foreshadowed by developments prior to 1930. One would expect, of course, that falling costs in 1929–1932 and the rise in the price of gold at the end of 1932 would cause a decline in the average grade. Previously submarginal ores became profitable and the working of such ores necessarily diluted the average. But a substantial fall in average grade due to this factor alone would require a large increase in the total output of gold. Obviously, what has been taking place is not merely dilution by adding low-grade ore to the previous output of high-grade ore but a concentration of effort in the poorer areas and a conservation of the higher-grade ores. Such a shift has been an objective of governmental policy, and the tax laws have been shaped to this end, but the volume under review fails to make clear whether the tax factor is adequate to account for the actual decline in the utilization of high-grade ore. At one point (page 93) the author lends his support to the widely accepted but fallacious theory that when costs are expected to rise [or the present price of gold to decline?] it will pay to work low-grade ores first lest they later become valueless. It is true, of course, that a rise in costs may cause deposits now profitable to become submarginal. This is an economic reason for expanding the scale of operations when costs are low, but it is not an economic reason for postponing the exploitation of high-grade ore; the added costs that will later make low-grade ores worthless will correspondingly reduce the value of high-grade ores. Anticipated changes in costs may determine the profitable scale of operations in the present, but they do not affect the profitable order of exploitation. In so far as that is subject to control at all, the controlling factor is the saving of interest from maximizing the earlier dividends.

The analysis of the anticipated rate of return required to induce speculative investment (pages 9–10) is not sound. Referring to the fact that the speculative rate necessary to induce investment in risky enterprises falls with the lengthening of the term of investment, the author says: "This is due to the fact that the longer the period the greater will be the contribution those destined to fail make during their success." But the table of speculative rates under discussion (quoted from D. C. Fraser) does not involve the assumption that the unsuccessful investments yield a return. It is computed on the assumption that the unsuccessful enterprises do not return either principal or interest, whereas the successful enterprises yield the speculative rate for a specified term of years and then return the capital intact, both the dividends and the return of capital being discounted at the safe rate.

The footnote on page 10 adds to the confusion, since the speculative rate is computed without any allowance for the loss of capital in the unsuccessful ventures. The formulae given can be justified only on the assumption that the unsuccessful ventures return their capital intact at the close of the period

of exploitation or, what comes to the same thing, that the successful ventures yield the speculative rate in perpetuity—an assumption which is, of course, inconsistent with the character of the mining industry.

CHARLES O. HARDY

The Brookings Institution

Banks, Credit, and Money in Soviet Russia, by Arthur Z. Arnold, with a foreword by H. Parker Willis. New York: Morningside Heights, Columbia University Press. 1937. xxiii, 559 pp. $4.00.

Mr. Arnold has written the first really comprehensive account in the English language of the Soviet monetary and credit system. It is true that that system has been briefly described and analyzed in a number of recent publications, and the very readable book by L. E. Hubbard which appeared in England last year cast a good deal of light upon the theory of the Soviet financial system. Mr. Arnold, however, set himself the rather different and much more complicated task of explaining the Soviet money and banking system by showing in detail how it developed through trial and error and the application and abandonment of various theories. The general treatment throughout is historical, beginning with three useful chapters on Russian banks, credit, and currency as they functioned before the advent of Communism. On the basis of official documents, and guided also by numerous other studies of Soviet monetary and credit problems, the author gives a detailed account: (1) of the nationalization and liquidation of the prewar banking system; (2) of the inflation of the "sovznak" or paper rouble during the period of so-called War Communism in 1918–21; (3) of the reasons underlying the creation of the State Bank in 1921 and of a new monetary unit, the chervonetz, in 1922; (4) of the difficulties encountered during the early years of the N.E.P. (1922–24) in making the new dual currency system function satisfactorily; (5) of the agony of the sovznak, its replacement (in the ratio of 1:50,000,000,000) by a new "gold" rouble, and the issuance of Treasury coinage in 1924; (6) of the evolution of the State Bank and the organization and growth of other Soviet banks; and (7) of subsequent developments in the fields of money, prices, and gold. The book is wound up by an excellent summary and an impressive bibliography.

One of the pertinent facts which Mr. Arnold brings out is the illusory nature of the theory held by some that the Communist régime deliberately sought to destroy the value of the sovznak. He shows that the abolition of money was not an immediate aim of the Soviet authorities, but only an ultimate ideal, and he explains how even Bolshevik economists were misled by the inflation and its concomitants into believing that money was soon to be permanently dispensed with. Considerable space is devoted to the unique currency system of 1922–24, in which a rapidly depreciating sovznak was circulating alongside a slowly depreciating chervonetz, that is, two paper media rather than two metallic media of payment were in circulation on what Mr. Arnold calls a "bi-paper standard." The fact that the chervonetz

bank notes did not depreciate as rapidly as the Treasury's issues of sovznaks appears, from this account, to have been due principally to the circumstance that the State Bank restricted its issues in order not to exceed the legally prescribed ratio between its metallic reserve and its notes. Both the chervonetz and the sovznak were inconvertible, but the issue of sovznaks had been freed from all restrictions and was, besides, the principal source of budget revenue.

With respect to the relationship between the chervonetz and the present rouble, however, Mr. Arnold gives less information than some of his readers may wish to have. The explanation is perhaps that, as he says, the Government's decree of February 5, 1924, ordering the introduction of the new rouble failed to state what the relationship was to be. Apparently no legal ratio of exchange between the two currencies has ever been fixed, although the State Bank has always effected conversions freely at the rate of 50 roubles to one chervonetz.

Soviet methods of planning are explained in this book to the extent that an understanding of them is essential to a grasp of the banks' functions. One comes away with a clearer conception of the gulf which separates Soviet banking from capitalist banking, owing to the subordination of Soviet banks to the whole scheme of planning. As Mr. Arnold summarizes the position of the banks in Communist Russia:

> They are not free entities to do as they please. . . . Their plans, like those of other enterprises and institutions, must be in line with the general policy. If their resources are not adequate to permit such compliance, the government will either provide them with additional means or, if that is impossible, tone down the projected expansion. Although they are permitted and even required to earn profit, this is not at all their leitmotif. It is a side issue with them. They have no choice whatsoever in selecting clients. If a client's approved credit or financial plan calls for a given amount of bank credit or budgetary financing, the bank in question must grant it, even though it may later invoke certain well-defined sanctions against him for non-compliance with the provisions governing the repayment or the use of such funds. Nor is the Soviet discount rate intended as a regulator of the volume of credit and currency, and of the flow of foreign funds to and from the country. Its sole purpose is to enable banking institutions to be self-supporting and to accumulate reserves.

From the above and the rest of what Mr. Arnold has to say on this subject, one comes to the conclusion that Soviet credit institutions are in reality more nearly branches of the Finance Commissariat than they are banks in the accepted sense of the word. But the author himself points out that the goodness or badness of a banking system depends less on the underlying theories or principles of the system than on how well it serves the needs of the particular economy for which it is designed. Without passing final judgment on the efficiency of the Soviet banking system, Mr. Arnold expects that, "in the absence of extraordinary happenings," that system will continue in the near future to develop along the present lines.

On that aspect of the Soviet monetary position which is perhaps of the greatest current interest—the size of the gold reserve and the volume of gold production—this book throws no new light. The author confesses that

the size of the Treasury's gold stock (i.e., apart from the State Bank's holdings) is unknown. Estimates of annual Russian postwar gold production made by other experts are to some extent reproduced and correlated.

Although Mr. Arnold cannot be accused of bias in respect of the Soviet State, some of his passages leave no doubt in the reader's mind that his economics are, on the whole, orthodox. These passages appear to be aimed at those who would attempt (or have attempted) monetary experiments in the United States rather than at the Soviet scheme of things. For instance, Mr. Arnold warns that, once a country is off the gold standard and its currency unredeemable, the possession of a gold reserve "no matter what its size" is an inadequate protection against inflation. He is of the opinion that "once inflation gets well under way it cannot be 'controlled' or stopped at will," largely because the preliminary step to such control—balancing the budget—cannot be accomplished overnight. At the same time, his criticism of certain phases of the Soviet economy and his praise for the comparative merits of certain policies adopted both proceed from an objective examination of the facts. After explaining the shortcomings of planning in the period preceding the Five-Year Plan, he adds sympathetically, "but just the same, planning in the Soviet Union is steadily improving . . . and even in its imperfect state it has proved of inestimable value to the economy of the country. The present planning apparatus and the planning methods employed today are far more scientific, far more complex, than they were during the earlier years of their evolution." In the light of the latest press reports of industrial confusion in the Soviet Union, this statement appears to err somewhat on the side of generosity.

Mr. Arnold's volume contains numerous statistical tables which will be found extremely useful not only by the student but for general reference purposes.

O. ERNEST MOORE

Federal Reserve Bank of New York

Land Utilization and Rural Economy in Korea, by Hoon K. Lee. Chicago: The University of Chicago Press (The Baker & Taylor Company, New York). Issued under the Auspices of the Secretariat of the Institute of Pacific Relations. 1936. xii, 302 pp. Appendices, maps. $3.00.

Considerable interest has developed in recent years in far eastern economic problems, but the emphasis has been very largely upon China, Japan, the Philippines, and the Dutch East Indies; and Korea, except as a colony of Japan, has been overlooked. Most of the information on Korean economics available in a western language has come from the Government-General's publications, and there has been almost nothing from Korean sources. Hoon K. Lee's study of land economy in Korea, therefore, comes as a welcome and much needed addition to our knowledge of Korean economics. It is a very honest piece of work, presented by a Korean scholar who has successfully subordinated political considerations.

The study was made in 1931 and 1932 and is based upon the examination of official documents and other literature and also upon a field survey which was conducted with the aid of 41 field workers using carefully prepared schedules. The sample is not large in relation to the total population, but it reveals important factors obscured in the statistical reports of the government. It would have still more value if the author had given a fuller account of the character of the farm households included and the determining factors of selection. For example, the field survey reveals a very much higher yield per acre for the major crops than has been yearly reported in the government statistics. The author states that the government statistics are based upon data reported by village clerks as their superficial judgment of the crop and without actual surveys. His field survey shows, in the case of rice, a yield 68 per cent greater than the government figures. With such a wide discrepancy in yields, it is important to know exactly the character of the farms included and whether, by some unconscious factor, they have been selected from the upper levels of efficiency, or if they are truly representative of Korean agriculture.

The statistical presentation, in general, is simple and definite. In measuring efficiency of farm labor, however, a fuller account of the character of the sample should have been given to aid the reader to evaluate the findings. The conclusion, on the basis of the data presented, that "the efficiency of women and juveniles is little more than one half that of adult men," is open to question. The maps in general are poorly conceived and do not give the instant graphic representation intended. Their fault is in the technique of construction, not in the data.

The first chapter, which presents the basic facts of climate, topography, resources, and population, is the poorest of the chapters and could have been omitted as most of the data presented are well-known and readily available. The historical data on population have not been sufficiently analyzed in the presentation for trends of population growth to be established from them. Large fluctuations in the figures suggest possible changes in the method of enumeration or other statistical faults. These criticisms, however, are minor to the main body of the work.

The study really begins with a second basic chapter on the characteristics of Korean agriculture and then goes on with a consideration of the problems of land utilization and ownership and related questions of capital investment in the land, rural credit, farm income and expenses, marketing of farm produce, and farm labor. Problems of tenancy are well presented and reveal a striking similarity to tenancy problems in China and Japan. There is also an interesting chapter on the standard of living, showing the decreasing per capita consumption of rice and the shift to millet. The last chapter deals restrainedly with the bitter problem of Japanese colonization in Korea.

The study is not exhaustive, but it is suggestive, and Professor Lee has done an excellent piece of work. He has opened up the field for Western

students and has disclosed many problems, not only of importance in their relation to Oriental economy but in the universality of their occurrence.

JOHN E. ORCHARD

Columbia University

The Economic Position of the Chinese in the Netherlands Indies, by W. J. Cator. Chicago: University of Chicago Press. 1936. Issued under the auspices of the Secretariat of the Institute of Pacific Relations by Basil Blackwell—Oxford. xi, 264 pp. $3.00.

The Southeastern corner of Asia, which has long been overshadowed by more spectacular events in other parts of the Far East, is emerging from its neglected position. With the freedom of the Philippines being much discussed of late, and with the noticeable progress of Japan's southward expansion, an increasing interest is being taken in this part of the world. The German-Japanese agreement against the Communist International, which was signed at the end of 1936, was reported to contain a secret clause aiming at the division of the Netherlands Indies into spheres of German and Japanese interest. Evidently there is no place where friction between West and East is more likely to develop than in these vast and rich tropical island possessions which are owned by a small western nation, threatened by Japan, and, probably, protected by British fortifications at near-by Singapore.

With the international scene changing so rapidly, it is of importance for any observer to know more of what is going on inside those Dutch islands, which are inhabited by 65 million people. An interested public, therefore, will gladly receive Mr. Cator's contribution dealing with the foremost and most complex interior problem of the archipelago. There have been large Chinese settlements on the islands ever since, under the reign of Kublai Khan, a Chinese expedition of 20,000 men was dispatched to Java in the 13th Century. With the coming of the United East India Company, which was the forerunner of Dutch colonial rule, these Chinese merchant communities enjoyed many advantages from the Company's permanent friendliness toward them. The Dutch recognized the fact that the Chinese, "as merchants, far exceed ours in ability." The protracted war between the Ming and Manchu dynasties that swept the coastal regions of Southern China helped to increase emigration from those provinces (chiefly Kwangtung and Fukien) to Java which is one of the most fertile islands of the world. Here the thrifty and energetic newcomers succeeded in penetrating the commercial life of the archipelago. As agents of the Dutch, especially of that "mighty wholesale dealer," the East India Company, the Chinese had achieved, toward the end of the Eighteenth Century, complete economic domination of the native population in the field of trade and, in some regions, also in the fields of agriculture and industry.

Today there are one and a half million Chinese inhabitants in the islands, who have retained their economic position amounting to a practical monop-

oly in the retail trade of the colony. Immigration from China is still going on, although to a lesser degree owing to recent restrictions by the Dutch authorities. In 1930, 63 per cent of the Chinese population in the Indies had been born there. These Chinese, even if admitted to Netherlands Indies citizenship, have kept the characteristics of a national minority. Of special interest is their connection with the Chinese Government, a point emphasized by Mr. Cator. There is a tendency, on the part of China, to take advantage of this group which has retained Chinese nationality according to the Chinese law, in order to increase exports from China to the Indies. Funds are being collected, by the Chinese Government, for numerous purposes including the purchase of war material, and several organizations in the Indies aim at strengthening the ties with China. Another aspect which might assume international significance is the connection among Chinese trading communities in different countries of Southeastern Asia. For example, one of the products handled by Chinese wholesale dealers in the Indies is rice, which is imported from Siam and Indo-China where intermediate and wholesale trade is also dominated by Chinese merchants.

Lack of capital and the dominant position of Western wholesale traders has largely restricted Chinese commercial activities to the field of retail trade. Here the Chinese merchant is superior to his native colleague because of an "inborn flair for business, and perhaps also on account of his other natural aptitudes." The European merchant, too, cannot hold his own against him because of the closer contact between the Chinese and the consuming native communities. In addition, the Chinese have cultivated an *esprit de groupe* which has developed closely interlocked communities of interest in the fields of commerce, agriculture, mining, and industry. This type of organization has proved to be the safest bulwark against interference with the Chinese trade monopoly, aimed at by Japanese competitors as well as by native co-operatives. The well established position of the Chinese community in dominating the profitable intermediate trade of the archipelago does not show any sign of breaking up.

The Dutch authorities have recognized the position of the Chinese community as an asset and a source of colonial prosperity. Although the Chinese are subject to legal provisions for foreign Asiatics, little grievance has been caused by discrimination, especially since no racial criterion has been adopted in the immigration policy of the Netherlands Indies. The Chinese, on their part, have been law-abiding. Allegations made by Mr. Cator as to the "grateful use of European bankruptcy law" made by the Chinese are contradicted, a few pages later, by the explanation that a great number of Chinese bankruptcies may be regarded as an immediate outcome of the lack of available reserve funds. On the whole, however, Mr. Cator succeeds in dealing objectively with the questions involved, although a more critical, at least a more extensive elaboration of the Dutch administration's policy with regard to these 1,500,000 strangers might be desirable.

Mr. Cator's book is a valuable contribution toward understanding of the

changing scene in the Far East, where the importance of racial contacts as a factor of political and economic developments is being increasingly recognized. The "extremely dynamic character" of this racial group, emphasized by this study, is apt to stimulate human interest in Far Eastern problems, which cannot be sufficiently understood through a purely scientific way of approach.

ERNEST O. HAUSER

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Social Work Year Book, 1937. New York: Russell Sage Foundation. Edited by Russell H. Kurtz. Part I. An Authoritative Record of Organized Activities. Part II. A Directory of 1,020 National and State Agencies in Social Work and Related Fields. Fourth Issue. 1937. 709 pp. $4.00.

This issue of the Year Book, which is published biennially, is the first issued under the editorship of Russell H. Kurtz. The earlier volumes published in 1929, 1933, and 1935 were edited by Fred S. Hall, who retired recently. The present volume follows the same general plan as the 1935 publication. A number of new articles have been added, some materials have been reclassified, and various articles have been revised. Probably the most significant new feature is to be found in the eleven articles on the social security program of the Federal Government. Significant, too, are the new articles in the field of public welfare services.

Part I entitled, "An Authoritative Record of Organized Activities," contains signed articles by 120 authorities on the subjects covered. The value of this part, which comprises more than 500 of the 709 pages of the Year Book, is enhanced by the classification of the topical articles in eleven groups: Planning and Support of Social Work; Child and Family Services; Social Security (Federal Program); Public Relief; Handicapped, Racial, and Foreign Groups; Delinquency and Crime; Health and Mental Hygiene; Labor and Industry; Leisure-Time and Group Activities; Social Work under Specified Auspices or in Specified Areas; and Personnel. The articles are of variable lengths, each usually adequate for the subject considered and with a bibliography at the end. Taken as a whole the articles deal with definitions, problems, programs, history, trends, finances, and present status of subject considered.

Part II of the Year Book, a directory of 1,020 national and state agencies in social work and related fields, describes the nature of 395 national agencies, public and private, 573 public state agencies, and 52 state-wide private agencies. The description of each agency when complete covers the address of the agency, the year of organization, the executive officer, the membership, the purpose, the activities, and the periodicals published. Incomplete information on some of the agencies reduces somewhat the value of this material. This directory has been extensively revised since 1935 to

make it an up-to-date and useful guide to organizations. The index to the volume is an aid to the systematic use of the directory as well as Part I.

Taken as a whole this Year Book is an improvement over previous volumes. Students of the social sciences, social workers, librarians, editors, and other professional groups will find this volume an indispensable handbook for reliable information in the broad and expanding field of social work.

VERNE WRIGHT

University of Pittsburgh

Real Property Inventory of Allegheny County. Publication of the Bureau of Business Research, University of Pittsburgh. (Statistical Handbooks Number 3.) March, 1937. x, 311 pp., 5 maps. $5.00.

Vital information concerning housing and important indices of the planes of living of families in each of the 490 census tracts in Pittsburgh and the rest of Allegheny County are shown for February, 1934, on the 253 pages of tables, illustrated on the 51 pages of maps, and described in the 10 pages of explanatory text.

Comprehensive information is given for each of 490 small areas in Allegheny County regarding dwellings, including their age, type, chief material of construction, condition, use, and, if owner-occupied, value. With respect to family units, data are shown on occupancy and vacancy, size as measured by number of rooms, heating, lighting, cooking, bathing and toilet facilities, the period of occupancy or vacancy, and, if rented or for rent, the asked monthly rental. With respect to families occupying dwelling units, data on race, number of persons in family, persons per room, and mode of transportation used by principal income earner to get to work and time required are shown.

These and other data were obtained by men and women employed by the Civil Works Administration and supervised by the research staff of the Bureau of Business Research of the University of Pittsburgh. In this survey the forms prepared by the Bureau of Foreign and Domestic Commerce for use in the Real Property Inventories made by the Government in 64 cities in the United States were used with no modifications except in the heading. The data for the Real Property Inventories taken under Federal supervision have been published by the Bureau of Foreign and Domestic Commerce for each metropolitan district, for each central city, and for the area outside of the central city but within the metropolitan district. For none of the 64 cities, with the exception of Cleveland, were these totals tabulated and published by the small, geographically constant areas called census tracts as they are in this locally supervised survey.

The totals for Allegheny County show that 82,754 families were without tubs or shower baths and 3,569 families had three or more, 136,566 families were without central heating facilities, and 3,952 owned homes valued at $20,000 or more. The totals are interesting, as are those for each of the 64 Bureau of Foreign and Domestic Commerce cities, but the numbers in each

census tract or other small area are ever so much more interesting, and such detailed data are much more vital to all those interested in the Greater Pittsburgh area. For example, 97 per cent of the families in one census tract in Pittsburgh had no tubs or shower baths, while 100 per cent of the families in other census tracts had one or more. One hundred per cent of the families in three census tracts were without central heating facilities, while only 0.2 per cent of those in another were in this condition and 75 per cent of the families in this latter census tract lived in single-family dwellings valued at $20,000 or more.

Such detailed data as these are of value to public and private organizations concerned with the development of the city and surrounding area, to social and health agencies, to realtors, to financial institutions, and to intelligent merchandisers. Public officials, welfare workers, and business executives will all profit greatly by studying intelligently the basic data presented on the pages of this volume. All terms are clearly defined, the tables are easy to understand, and the maps not only are attractively presented but each tells an interesting story.

Although some of the data are already obsolete, such as those relating to vacant family units, most of the data are still pertinent and will remain substantially so for some time. While several tables show percentages instead of numbers, one table combines numbers on the left side and percentage bar charts on the right, making it possible to grasp easily the relative conditions in each census tract. The final tables show nonresidential units by type of use.

Data comparable to these are available in fewer than a half dozen American cities and for but two greater city areas, namely, the Cleveland Metropolitan District and Allegheny County. No attempt was made to interpret the data. Had such an attempt been made, several additional volumes would have been necessary.

HOWARD WHIPPLE GREEN

Real Property Inventory of Metropolitan Cleveland

Plans for Stimulating Suggestions from Employees, by F. Beatrice Brower. New York: National Industrial Conference Board, Inc. N.I.C.B. Studies Number 231. October, 1936. viii, 51 pp. $2.00.

This is a monograph based on a survey of the experience of 338 companies operating suggestion plans. The information was apparently gathered solely through questionnaires, without any field work. There are some types of research in which the questionnaire method has decided limitations, and this is certainly one of them. For, although the monograph does contain a useful compendium of the structure of suggestion systems as far as requirements and procedures are concerned, its vital section on the experience with suggestion plans lacks insight because it relies entirely upon what companies themselves report.

For example, of what real value is the specious table on page 42 on the

causes of the discontinuance of 116 plans, in which the major items as reported by the companies were 62 cases of "lack of interest," 39 cases of "employee dissatisfaction," etc. Anyone who has ever studied suggestion systems first-hand and in the actual setting knows that they are often so poorly handled by the management that blaming the employees is often an alibi, a rationalization, or at least a faulty diagnosis.

One wonders why so important an organization as the National Industrial Conference Board will continue to make superficial surveys in territories where it should have field studies rather than mere compilations.

HERMAN FELDMAN

Amos Tuck School, Dartmouth College

Classification of Business Literature. Prepared by the Library of the Harvard University Graduate School of Business Administration, George F. Baker Foundation. New York: H. W. Wilson Company. 1937. xv, 257 + 33 + 58 pp., photolithographed. $5.00.

The Harvard Classification is a joint effort of the School of Business Administration and the Baker Library. It is a direct outgrowth of the rapid expansion of the Business School Library, where it has been tested in actual use.

The scheme has a unique approach, being based on four considerations which determine the internal and external relationships of business. These are: (a) the relation of business to other subjects; (b) the element of time; (c) the functional divisions of business activities; and (d) the relation of business functions to particular business institutions. This series of relationships is clearly seen in the main stem of the classification, which contains sections lettered A–Y. If we select those main section headings which use the word business, we find it in five successive groups. (A) Business: generalia and general relations to government; (B) Business and economic theory; (F) Business and economic conditions; (G) Business and economic history; (H) Business organization and administration. It will also be noted in this illustration that sections B, F, and G each provide for a different phase of the relationship between business and economics.

It will thus be seen that the correct classification of material under the Harvard Business scheme will demand careful analysis of the subject matter of each book or pamphlet, as to its relationships. There is, in the usual sense, a departure from the principle of subordination, but there is also an expansiveness which is often lacking in a classification system for a special field.

The main classification (the skeleton structure of which we have just been discussing) has three parts: the subject analysis, for which a letter notation is used; the industries list, which is a decimal scheme; and the local or geographical list, also on a decimal basis. The section of most interest to us is the one lettered D: Methodology of research and control, for it is here that we find in detail the outline for the statistical method per se, lettered DB to DEY.

The main heading is Statistical Methods. The headings next subordinate, and commensurate with each other, are Statistical theory, Units of measurement, Data collection, Statistical tables (methods of construction), Statistical operations, Statistical analysis, Use of statistical methods as a tool in business and price forecasting, and Graphic representation. Let us select two of these groups for more detailed examination: DC: Statistical analysis, and DE: Graphic representation. Under DC we find, in turn, five subdivisions: Frequency distribution, Time-series analysis, Index numbers, Correlation, and Sampling. Again breaking down the most detailed section, Time series analysis, we find that provision is made for Trends, Seasonal variation, Cyclical variation, Incidental influences, Fourier and periodogram analysis, Method of variate differences, and Theory of smoothing and moving averages. Returning to the second of the two divisions of the statistical method which we selected as fairly representing the classification, we have the six subdivisions of Graphic representation: Scales, Time series, Correlation diagrams, Frequency charts, Area and map charts, and other graphic devices, as bars, blocks, pies, etc.

The key-terms of the statistical schedules, such as frequency charts, sampling, curve fitting, etc., are well brought out in the index to the classification. We do note three omissions: (1) Population growth; (2) Consumption requirements (that is, these headings in the index give no reference to our class number DDBJ, a part of the outline for the statistical method); (3) Tables (statistical). No doubt the index was made on the principle of guiding one to the subject itself rather than to methods of analyzing that subject.

The fact that the Harvard Business Classification is based on an actual book and pamphlet collection (that of the Baker Library) gives point to our next consideration. This is to discover, through the classification and its index, what treatment has been given to the statistics of particular subjects; i.e., under what subjects it was found necessary to make specific provision for statistical material.

We find statistical material provided for (in index or text) under a number of subjects which we may call roughly "utilities." Beginning with public utilities as a whole (VDD), we find waterworks (RUC), transportation (VJS), motor transportation (VOP), street railways (VSJ), railroads (WAO), pipe line transportation (WHD), railroad traffic management (WDMH), air transportation (WKN), water transportation (WNO), inland water transportation (WQE), port and terminal facilities (WQT), express companies (WWF), postal service accounting (WXF), communications industries (YAH), telegraph and cable (YBH), telephone industry (YCK), radio communications (YEW), electric light and power industry (YJL), district steam heating (YNF), gas industry (YPJ), and water supply (YRK). In each case the heading, or class grouping, is commensurate with headings like history, theory, organization, etc.

Another group, treated in much the same manner, we may term "con-

struction industries." These are construction (RND), bridge construction (RQD), shipbuilding (RSD), waterway improvement (RTD), highways (VNE).

In the marketing group, we find marketing in general (SBJ), wholesale marketing of institutions (STE. "Not sales. For sales see FS"[1]), retail selling (SVC. "For statistics of sales see FS"[1]); storage warehouses (SUE), foreign trade, exports, imports, commodities (TE and TF).

The types of statistical information to be found in the Federal census volumes are provided for under population (EP. "Enumeration. For general works see CB"[2]). The word statistics is not used in the text in each case, but the index shows us that vital statistics, and statistics of age, sex, social condition (domicile, family, occupation, property), race and nationality, migration (immigration and emigration), wealth, and income, are meant to be placed within the EP group. With this group of the "social" statistics should also be mentioned LDNE—statistics of old age insurance and superannuation.

There remains a list of headings under which business statistics are provided for. We find these under the large class F: Business and economic conditions, surveys, and forecasts. Again, the word statistics is in most cases mentioned in the index only. We have statistical yearbooks and Government annuals (FA), individual business enterprises (FC), production (FP), sales and consumption of goods (FS).

Under KBFU, we find statistical reporting of Federal Reserve banks; under MF, statistics of land and land economics; under MTJ, real estate statistics; under RAE, manufacturing statistics, and under RYFS, the statistics of governmental services.

In addition to all this specific provision for statistics under subjects, we find in a general material-form list, a form subdivision for statistics (.04), which may be used wherever needed, at the discretion of the classifier.

From this examination it would seem that both statistics as a subject, and statistical data as a type of material, have been well provided for in the Harvard Business Classification, with respect to inclusion of all important items. The indices, the cross references and the frequent annotations are all features which assist the classifier in placing material correctly, and which make more clear the philosophy of relationships on which this scheme is based. The plan will also be helpful to some as a guide to business subjects. The possible adaptations of the various elements of the Harvard Business Classification carry its usefulness outside its particular subject field.

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[1] Under: Business and economic conditions, surveys, and forecasts.
[2] Under: Sociology (demography).